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The Engineering Department Modernized

Designers in Individual Rooms—Responsible Heads for Blueprinting and Drawing Storage — How Records Are Kept—Single Machines Built First in Model Room

BY H. W. DUNBAR AND W. E. FREELAND

THIS article describes the organization, personnel and system of an engineering department drafting room as actually operated by the Northern Grinding Company, Worcester, Mass.

The details of the complete system of this engineering department and the procedure followed in the drafting room are applicable in any factory doing a considerable volume of business, a large part of which requires special attention, instructions

hit-or-miss manner would create chaos in these days when the machine-tool builder has to give to each machine special consideration of its individual and special purpose. In the drawing room organization to be described, Bill has his particular kind of work to do and becomes expert in doing it. By this it is not intended to convey the idea that each man becomes a specialist in some particular drawing room operation, such as drawing, tracing, designing, etc.,



Fig. 1—In the Drafting Room of the Norton Grinding Company the Detailers and Tracers Are Placed in the Main Room and Designers and Men on Special Work Are Given the Small Rooms Extending Down Each Side of the Main Room

or consideration on the part of the engineering department. The methods outlined will be found serviceable and successful in any drafting room with little change.

Organization, as is generally recognized, is one of the principal assets in the carrying on of a large volume of work in a drafting room where the product of the factory is employed for a diversified class of operations. To follow out the old procedure of letting Bill do this, that, or the other job and distributing the work through the department in a

but rather that he becomes expert on some special class of work. He may devote his time solely to the designing of machinery for use in the automobile industry; to handling that line of work known as standard drawing practice which includes such work as standardization of drawings, changes in existing drawings to facilitate manufacture or to keep them to the standards of present-day manufacturing practices; tool designing; sales engineering work; the clerical work such as scheduling of parts; listing and supplying repair orders; or again, such a

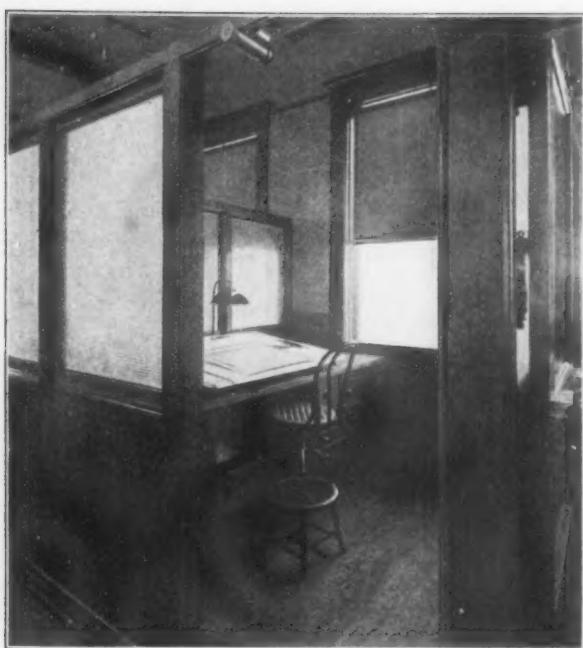


Fig. 2—Each Man on Special Work Has a Separate Room to Which He Has the Key. The rooms serve to eliminate distraction and lessen the chance for leakage of undesirable information concerning undeveloped problems

division of the work as the handling of record cards and the filing of drawings.

When one considers what constitutes a thoroughly successful drafting room, it becomes quickly apparent that not alone the scheme of organization, but also the personnel of the organization plays a very important part. The men of a department usually reflect in their work, their attitude and their character, the characteristics of their superiors. It is essential that there shall be harmony between those directing the work and those actively employed in carrying it out. Loyalty is a chief aim. Pleasant surroundings, convenient places to work, contentment, a sense of security in one's job and a system which is a servant and not a master of the organiza-

tion will go a long way toward developing this sense of loyalty, both to the department and to the company—a loyalty which yields returns in quality and quantity of work that can hardly be measured by any standard.

Here enters the problem of the selection of men, the sources from which they can be obtained and the standards by which their service value is measured. As this article is not to deal with these questions, no comment will be made on these points.

The development of team work among divisions in the drafting room, as well as among individuals, is carried out consistently. The work is organized to abolish, so far as possible, cliques or personal jealousies. Each individual, while knowing that he is a part of a big machine, is made to feel also a sense of responsibility and a broad interest in the welfare of the company. The prime thought in the development of the system is that it must be so explicit as not to make it burdensome, but so simple that its routine working furnishes the easiest way to do the job; so concise that there will be no tendency to cut corners.

This preface to a detailed description of the practices employed by the Norton Grinding Company in operating its engineering drafting room has been written to make plain the attitude of the management, a factor which forms the foundation upon which all successful organizations stand.

LAY-OUT OF DRAFTING ROOM

Before proceeding to a description of the organization itself, let us glance for a moment at the lay-out of the drafting room. In the engineering department of a manufacturing plant where the problems come from so many different classifications of manufacturing, the question of properly handling the drafting work has always been a big problem. Many undertakings are of such a nature that it is often desirable that as few people as possible be acquainted with the work as there are at best too many channels for undeveloped problems to find their way outside of the engineering department.

Many considerations point to the necessity of providing those engaged in specialized study work on engineering problems with inclosed working quarters where they can carry on their special work to the best advantage with little or no interruption or interference from their co-workers.

It will be noticed in the illustration of the drafting room that separate booths for this special work are located on either side of the main drafting room. Fig. 2 shows a detailed arrangement of an individual booth in which one of the men assigned to the study of difficult problems is located. The inclosure of these rooms is by partitions of rifle glass about 8 ft. high and set up 12 in. from the floor, providing adequate means for keeping the floors clean and insuring good lighting facilities and ventilation for the whole room. As the glass is not clear and cannot be seen through, the possibil-

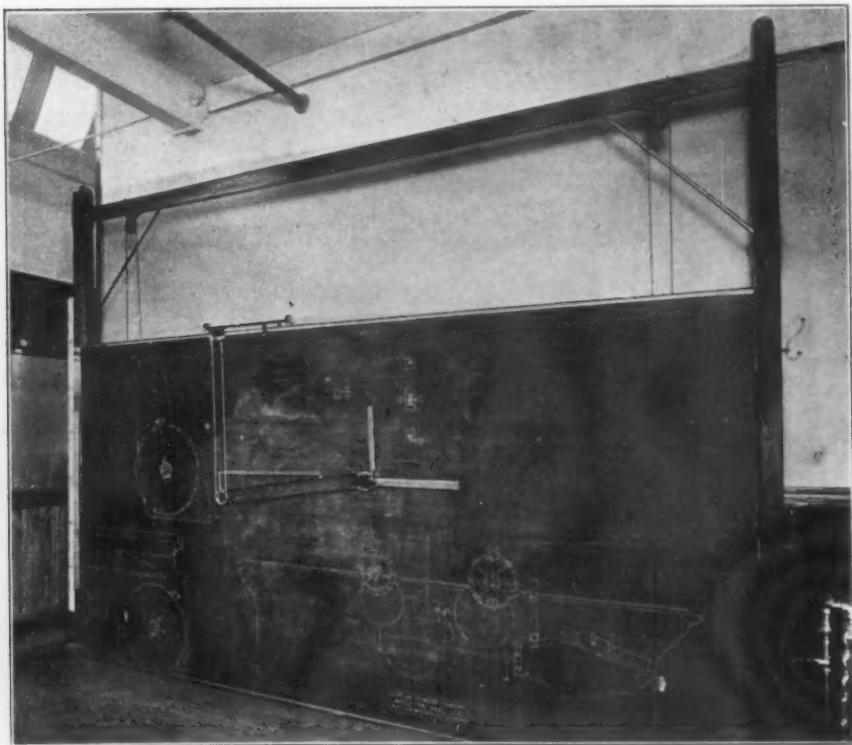


Fig. 3—with This Large Blackboard It Is Possible to Lay Out a Machine on a Full Scale. It is possible thus to make physical tests of the convenience and accessibility of levers and hand wheels. The board is counterbalanced for quick adjustment to desired height

ity of distraction from work, either by sound or sight, is greatly lessened. The rooms are ample in size for one man, and, if pressure of work demands it, will accommodate two men comfortably. Each room has a window and heating facilities and all are under lock and key, no two keys in the entire room being alike.

Personal comfort and convenience always yield good returns. The view of the main room will immediately create the impression that little has been spared in this direction. The lighting is by indirect diffused daylight from a northern exposure. The walls are tinted in a color which absorbs the light rays most disturbing to the eye and yet has good reflecting power for light distribution.

A most serviceable feature of the drafting room is a blackboard for full-size drawings. It is arranged to slide up and down and is held at any desired height by counterweights. It is equipped with a special Universal drafting machine. A drawing to full scale of a machine is started at the bottom of the board so that when the board rests on the floor it is possible to judge accurately the location and convenience of levers and hand-wheels on machines being designed.

Each drafting board is equipped with individual lamps and the latest type of Universal drafting machine is used exclusively. The drawing tables are especially designed with chests of drawers arranged for the particular class of work to be handled. Much thought has been given throughout the whole department to the use of those modern appliances, which lighten the work or increase the efficiency of an engineering staff, such as the curvograph, photostat, continuous blue-printing machine, and washing and drying machine and other appliances of similar character.

The curvograph with its rapid and convenient method of drawing arcs of unusually long radius is of particular use in this department owing to the fact that the Norton Grinding Company does a considerable business in the design and manufacture of equipment for grinding automobile cam shafts. The photostat has been utilized to copy original drawings sent in by customers in place of the older method of making or tracing shop drawings with the consequent elimination of errors in the copy.

PLAN OF THE ORGANIZATION

The chart of the department organization shows how the various activities and responsibilities are co-ordinated, and needs no explanation. The only point which needs emphasis is that division of responsibility, as shown by the chart, really exists and that most of the questions arising among the men at work on the boards are settled by a division head without reference to the department head.

That division of engineering or drafting work which comes under the classification of vault management has always been a source of annoyance in nearly every drafting room, primarily because of the fact that it is difficult to locate drawings where thousands of them are active, difficult to get clerical help with the needed qualifications of neatness and

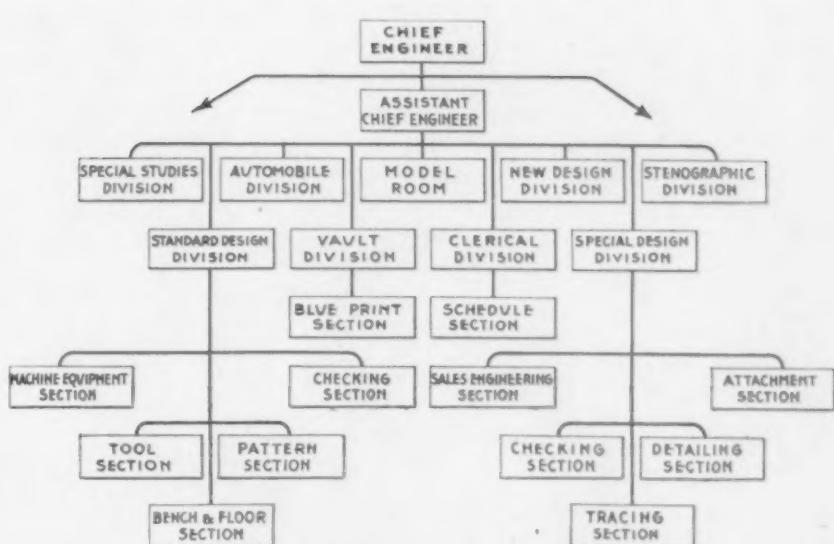


Fig. 4—Chart of the Subdivision of Responsibility in the Engineering Department of the Norton Grinding Company, Worcester

accuracy to keep up the vault system, and difficult because of the variety of work and need for good, sound common sense and judgment at all times. It is probably true that the reason for the usual conditions in vaults can be charged largely to the fact that most drafting rooms employ the services of a young man or an inexperienced boy as clerk to carry on this work, holding out this position as a stepping stone to the drawing board.

It has been quite thoroughly demonstrated in the experience of the Norton Grinding Company that this practice causes not only annoyance but needless expense. The vault system now is in charge of a competent man, paid a reasonable salary for his services; he has the interest of his division at heart and is not looking forward to the time when he can jump from his present position to one on the drawing board. The ordinary blueprint boy simply considers the vault work as a position where he must serve a certain length of time as a penalty for the privilege of becoming a tracer, whereas the man paid to do that duty makes that his one job—in other words, his vocation—and he is always trying to improve the condition of his work, enhance the



Fig. 5—The Curvograph is Commonly Used to Lay Out Cam Outlines. It enables one man on a single board to do what formerly required two or three men and the use of four or five boards joined together



Fig. 6—The Working Quarters of the Vault Department. The filing cases on the right, which hold the schedules, are on casters so that they can be rolled into the vault at night. Over them is a permanent shelf on which are trays to hold each size of drawing so that the drawings are partly sorted as they are returned

value of his department and make it easier for him to perform his duties. The layout of the vault is arranged so that it occupies as little space as possible and is neat and convenient.

The unit size of drawings is 7 x 10 in., and all larger sizes are multiples of this unit. The two smaller sizes, 7 x 10 in. and 10 x 14 in., are filed vertically in special fiber envelopes. Tracings, drawings, blueprints, etc., are all placed in the same envelope in numerical order. One envelope holds ten successive numbers, which represents about fifty drawings and prints, and each tenth envelope has an index tab to designate the hundreds. These envelopes keep the drawings in good condition and the unit grouping makes reference easy. The larger drawings up to 28 x 40 in. are filed flat in drawers in the same type but larger envelopes.

Schedules are placed in envelopes and filed flat in cases mounted on castors so that they can be rolled into the vault at night. A shelf over the schedule cases holds trays designed to receive each size of drawing returned to the vault so that the

drawings on blueprints are sorted ready for filing as they are received. Fig. 7 shows the envelope in which the records are kept in a systematic and simplified way.

HOW DRAWINGS ARE CHARGED OUT

One of the newest things in the work of the vault system at this plant is the method of charging out drawings, blueprints and schedules. The old system of charging out drawings was to have each draftsman leave a list in the vault in the form of a little ticket with his name and the number of the drawing written upon it, whether it was an original, blueprint, tracing, record, pattern print, or whatever it might be. That system made it necessary for the vault attendant to search a card file to find the size of the drawing issued in order to get a means of locating it in the drawing file. Under that system he must thumb over a large number of cards and eventually find the number and size of the sheet which is an index to its place in the file. Then the attendant goes to the drawer where the drawings are supposed to be filed, and after running through a number of drawings finds the place where the drawing needed should be located and eventually discovers that this drawing is out, so he refers to a third file where the little cards were put away and there finds that a certain member of the department has the drawing, blueprint or whatever it is that he is looking for.

A more convenient system for handling the charging out of drawings is accomplished by the Rand visible card record index, which opens like the leaves of a book and can be readily referred to. At the bottom of each card is typewritten the number of the drawing and its name and size. This size determines its place in the files. If any of the various records are charged out to the departments, a celluloid signal is placed in the pocket of the index, which is also of celluloid. These signals are of different colors and identify the different types of drawings: a red signal represents the original drawings; a blue signal the blueprint; a

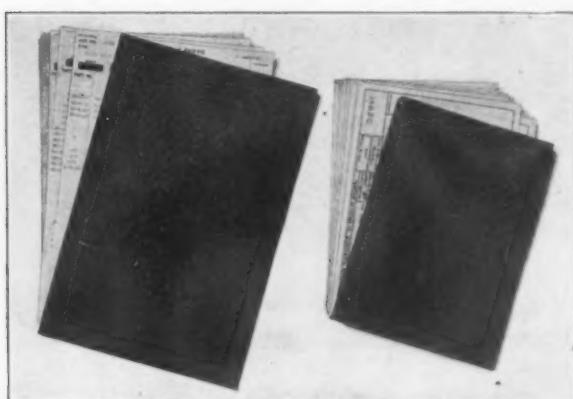


Fig. 7—Envelopes. Closed at the Bottom and at One Side Hold Schedules and Drawings. The envelope at the right contains in numerical order all drawings and blueprints of ten successive numbers—usually about fifty in all. By this grouping any drawing desired may be quickly located

green signal the pattern print; an orange signal the record print, etc. These little signals have numbers stamped or printed on them to correspond with each individual in the department.

The procedure to find a drawing is materially simplified by this system. Each name and number is in clear view by simply turning to the proper index, whereon the numbers are arranged numerically. The number is asked for and the vault assistant refers to the proper leaf indexed with the drawing number called for and locates the position of the drawing on the individual leaf. He finds the size of the sheet, which directs him to the proper drawer in the file. He also notices as he looks for the number that there are two signals against that number. One is red and one is blue. Immediately he knows that the blueprint and the original of that drawing have been taken out. He observes that both the signals have "10" stamped on them. By referring to his index he finds that No. 10 is Jones, so he replies immediately to the inquirer that the original and blueprint are in the hands of Mr. Jones, therefore he cannot produce them.

It is evident that a great deal of time is saved by this system and its convenience is made plain by a glance at Fig. 8.

SOME DEPARTMENTAL FEATURES

As it is the practice of the Norton Grinding Company to put out new blueprints with each new lot of parts to be built, it is necessary to make a considerable number of blueprints each week. Experience has proved that it is cheaper and better to issue new blueprints than it is to collect, correct and preserve old ones. Changes in drawings are not overlooked, as may occasionally happen when old blueprints are used. At the present time about 8,000 or 9,000 sq. ft. of paper is printed weekly. The blueprint equipment is of the latest improved type, including a Revolute mercury vapor continuous blueprinting machine and a Revolute washing and drying machine.

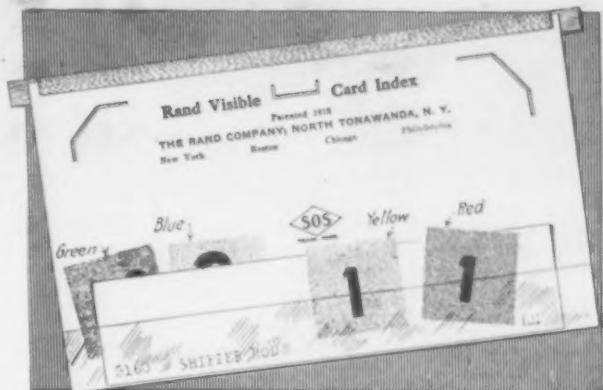
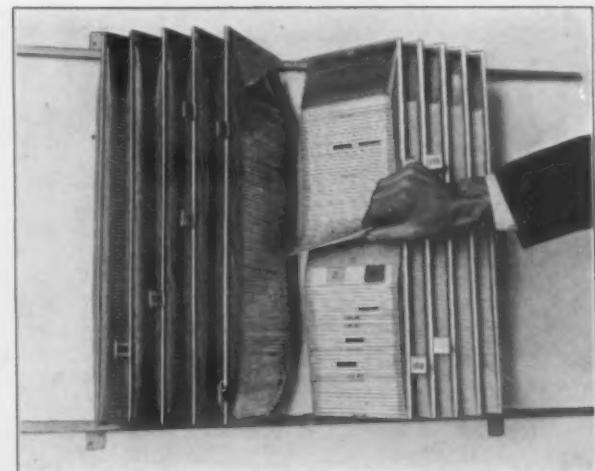


Fig. 8—The Vertical Index is Used for Charging Out Drawings. Each draftsman has a set of celluloid markers of different colors which he surrenders when obtaining anything from the vault. The markers bear a number indicating the man and are of different colors to indicate whether he has taken a drawing, blueprint, pattern print, etc. This file tells the vault clerk at a glance whether any drawing requested is in the vault or who has it

The work of the blueprinting room is carried on entirely by a young woman, and it has been found that the advantages of a permanent oper-

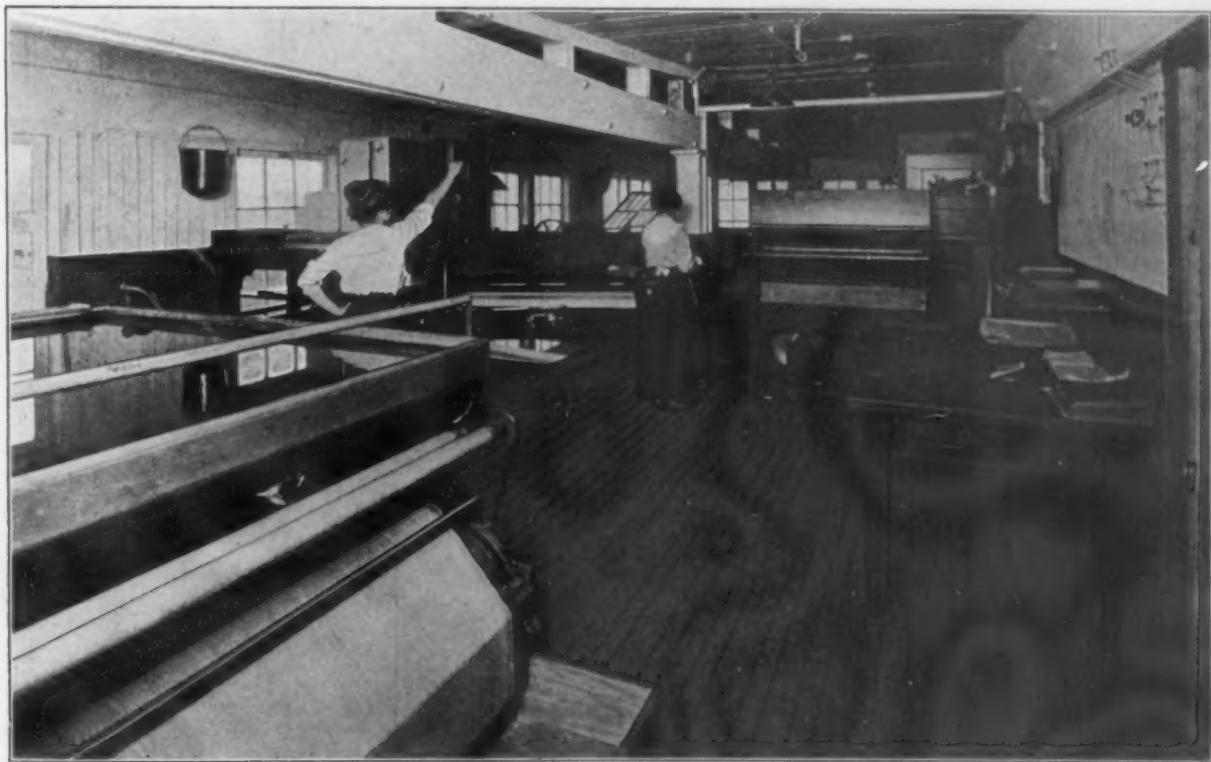


Fig. 9—The Blueprint Room is Equipped with a Revolute Mercury-Vapor Printing Machine and a Revolute Washing and Drying Machine. The average time to make a blueprint in the ordinary routine is 4 min. A photostat is used to make copies of customer's drawings

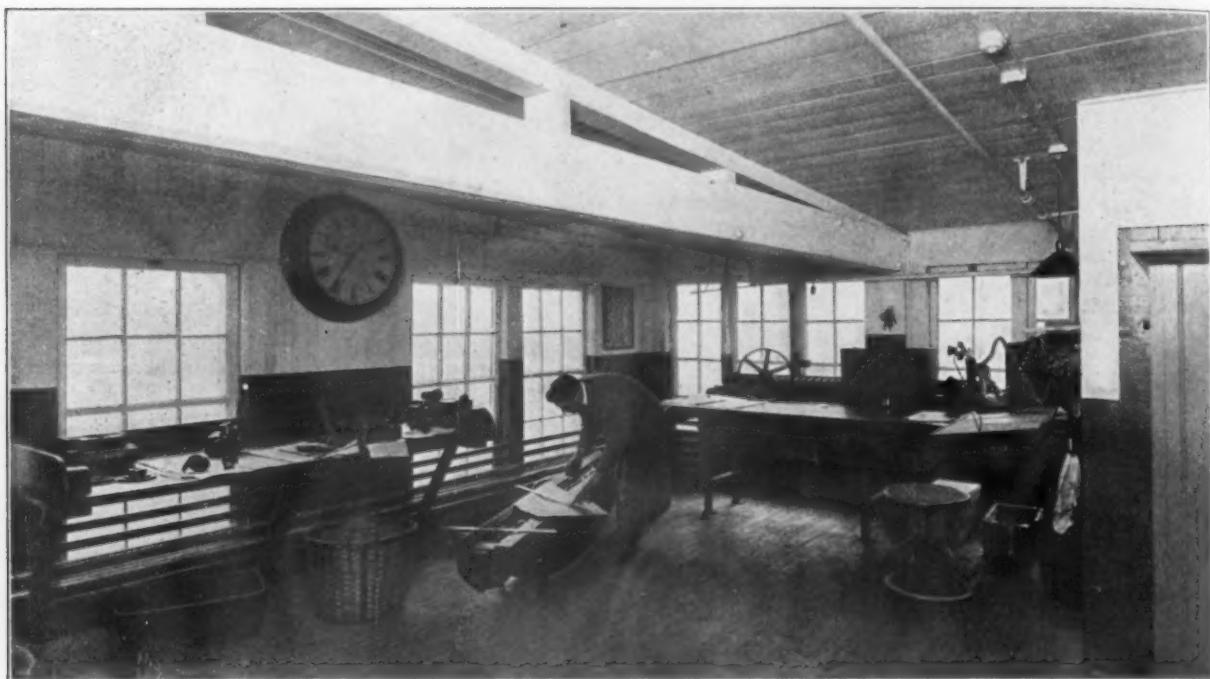


Fig. 10—The Pattern Supervisor Has Commodious Quarters in Which to do His Work

ator on such work are practically the same as having a permanent head of the vault department, inasmuch as operators regularly employed take more interest in their work and are always striving for improvement.

As all patterns, both new and old, are controlled by the engineering department, it is necessary to employ the services of a pattern supervisor who is thoroughly familiar with the patterns, with the company's way of making them, and with the foundries' ways of handling them. His duties include the checking up of all patterns as they come from the pattern shops; the control of their movements from one foundry to another under the direc-

tion of the manufacturing organization; the making of contracts for new patterns, and the keeping of an accurate record of their condition. Fig. 10 shows the convenient and comfortable quarters of the pattern supervisor's department.

One of the unusual features of the engineering department of the Norton Grinding Company is the model department, which employs half a dozen skilled mechanics under the direction of the engineering department. This department is well equipped with all the machines necessary for carrying on machining operations, including small tool equipment and accurate measuring instruments. All new machine attachments or mechanisms de-



Fig. 11—All Machines and Mechanisms Designed by the Engineering Department Are First Built in This Model Room Before Manufacturing Orders Are Issued. Thus it is known that they will perform their proper functions and manufacturing problems are solved before regular machining operations are started

signed in the engineering department are first built in this department. Here, before it is marketed, is proved out everything made by the Norton Grinding Company, so that when the blueprints for new construction are turned over to the manufacturing department as a manufacturing proposition the machines or parts have been built. The machine operations are known factors which have been reduced to the simplest possible form and from the designer's point of view it is known that an attachment for a machine will successfully perform its proper function. By having work first built in this model room all questions of design, adjustment and workmanship are brought promptly to the attention of the engineering department and decisions are more readily made.

(To be concluded, the second part covering among other things the way engineering work in progress is followed up, the way work is assigned and the way changes in existing shop drawings are made, and also the special shop instruction given to draftsmen.)

No Change in Thomas Iron Company Ownership Is Now Expected

Concerning the recent negotiations for the purchase of the Thomas Iron Company's blast furnace, iron ore, railroad and other properties in the Lehigh Valley, the company has issued the following statement:

"The management of The Thomas Iron Company wishes the trade to understand that no option to purchase its plants exists. At a meeting of the stockholders in September a Mr. Person, who claimed to represent Philadelphia bankers, read a statement to the effect that he was making the stockholders a cash offer of \$3,500,000 for the assets of the company as of June 30, 1916. The stockholders appointed a committee to confer with the parties represented by Mr. Person and passed a resolution stating that it was the sense of those shareholders attending the meeting that they would sell on the basis of \$3,500,000. Meetings of the committee have been held but there has been no evidence shown that the parties represented by Mr. Person have the ability to carry out the offer made at the meeting of the stockholders. Statements have been made that 10 per cent or more of the purchase price would be deposited in various banks, but no money has been deposited and no evidence furnished that Mr. Person or his associates have any such sum as is required at their command. Owing to the improvement in the company's business affairs, due to the improved condition of the iron business in general, it is hardly possible that a majority of the stockholders would approve a sale on the basis of Mr. Person's offer at this time. Operations have continued at the various plants and no change in ownership has been or is now expected."

Another Steel Plant at Canton

The Canton Sheet Steel Company, Canton, Ohio, will build an open-hearth steel plant to supply its requirements of sheet bars. The plans provide for three 50-ton open-hearth furnaces, two soaking pits and a combined continuous blooming mill and sheet-bar mill. It is the intention to provide an ingot capacity of about 100,000 tons a year. The company is at present consuming about 90,000 tons of sheet bars per year. Its rolling equipment now includes 12 hot mills and 6 cold mills and its galvanizing department has a capacity of about 60,000 tons a year.

Creditors of the Wisconsin Engine Company, Corliss, Wis., which went into bankruptcy early in 1913, are receiving checks in payment of the fourth and final dividend of 2.59 per cent, amounting to \$8,213.73. The total disbursement is \$43,097.97, or 13.59 per cent. Claims allowed amounted to \$317,129.48.

Controller for Machine-Tool Motors

A drum-type controller for use in connection with any class of motor-driven machine tool has been developed by the Cutler-Hammer Mfg. Company, Milwaukee, Wis. It is made in standard sizes for use with motors ranging from 1 to 25 hp. and provides speed regulation with a maximum range of 3 to 1. The former is obtained by inserting resistance in the shunt field circuit, the resistance in the armature circuit being intended for use in starting only.

The field regulating unit consists of a commutator mounted on the drum shaft and the necessary resistances in the form of ferrule type units located in a ventilated case underneath the controller proper. Contact clips at each end provide the connections to this special commutator and eliminate all lead wires. The starting resistance in the armature circuit is mounted on a separate frame. The contact fingers and segments of the armature circuit used in starting are of solid copper and, it is pointed out, are readily renewable. When the drum is returned to the off position, the arrangement of the fingers and segments is such that dynamic braking is provided.

If desired, the handle can be removed and a gear or sprocket drive to the controller spindle substituted. This arrangement, it is emphasized, enables the control to be brought to a convenient point, such as the apron of a lathe. If protective panels are used in connection with the controller, they are mounted upon the frame containing the resistance used in starting.



A Special Resistance Is Inserted by this Controller in the Field of a Shunt Motor Driving a Machine Tool to Provide Speed Regulation in a Range of 3 to 1

New Method of Sintering Ore Fines

A new method of sintering fines consists in first forming a porous hearth on the bed of a sintering pan about $\frac{1}{2}$ in. deep, made usually of limestone screenings. On top of this moist or dry fines are placed, mixed with coke dust if necessary. The charge is then ignited similar to the Dwight-Lloyd process and the combustion is maintained by drawing air through the charge. The new feature, as patented by Max McMurray, Benjamin J. Mullen, and Harry Peppel of Cleveland and Leetonia, Ohio (U. S. 1,183,891), consists in adding water to the charge continually or intermittently, as required, after a sintering heat has been attained. This water forms steam, which passes through the charge with the air. The claims of the patentees embrace the following: The time required is reduced from 25 to 50 per cent.; the product is more uniform; the exhaust apparatus may be run at a lower vacuum, and the grate bars have a longer life.

The Gulf States Steel Company reports its November net operating income at \$304,490, being an increase of \$221,600 over November, 1915, and of \$87,269 compared with the average for 10 preceding months of this year. After allowing for depreciation, taxes and reserves, the net income for November was \$281,788 and for 11 months \$2,226,982 against \$532,950 for the same period in 1915.

A news special from Lewistown, Pa., says that 33 carloads of rolled steel wheels mounted on axles and ready for service left the yards of the Standard Steel Works Company Dec. 11 for export, being part of a large order from China.

The Organization of Manufacturing Plants*

The Close Relations That Need to Be Established
Among the Estimating, Designing, Production and Man-
ufacturing Departments to Secure the Best Efficiency

BY A. D. C. PARSONS

THE most convenient way of considering the manufacturing side of works organization is to examine each section in the order in which these sections will have to deal with any particular contract, and then to discuss some system of production designed to follow through the manufacture methodically. Two natural divisions present themselves, (1) Preliminary to receipt of contract, (2) After the contract has been obtained.

WORK PRIOR TO RECEIPT OF ORDER

Before an order for any particular machine is received an estimate must be prepared in accordance with the specifications of the intending purchasers. The estimating department must have from the designing staff the information which will enable it to determine the requirements of new tools and special appliances to carry out the manufacture. It will also require to know with considerable accuracy the amount of labor and material necessary. The majority of specifications are necessarily somewhat lengthy, and it is essential that the estimators should be competent to investigate all details, and foresee any possible causes of trouble and expense which might result should any of these be overlooked.

In determining the time promised for delivery the capacity of the works and the number of orders on hand must be carefully considered. Guesswork must be as far as possible eliminated. It will be useful, therefore, to have some graphical representation of the fullness of the factory. Fig. 1 shows one way of arriving at this.

The ordinates in Fig. 1 may be in any convenient unit such as £'s, hp., kw., or number of machines, but in many cases the most convenient unit will be "machine time per week." In the majority of works each machine-tool will be rated at a certain figure per hour, depending upon the capital expenditure on the tool, and all work done on any particular tool will be charged with that rate per hour.

The estimating department will know approximately the amount of machine time necessary for each order, and if by means of some equation this can be spread

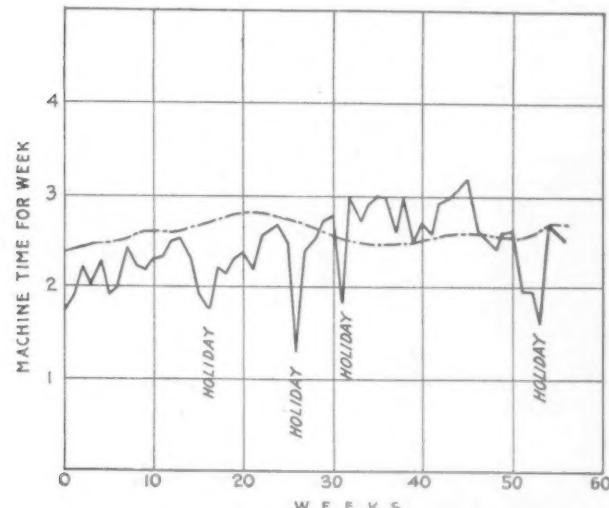


Fig. 1—Diagram Which Prevents Unreliable Delivery Promises

out over the time during which the order is in the works, an approximation can be made of the machine time to be expended per week. This is done for each

*From a paper on "Works Organization" presented at a meeting of the North-East Coast Institution of Engineers and Shipbuilders, Newcastle-upon-Tyne, Oct. 26.

order and the results superimposed on one another, thus obtaining the curve shown by the continuous line in the figure. It is also possible to plot the total actual machine time used in the manufacture of these orders, thus giving a fair idea as to whether the output bears a satisfactory relation to the amount of work actually on the books. The latter curve is shown dotted, and from this a measure of the capacity of the works can be found by averaging the actual machine time per week over the period of, say, one year.

Diagrams of the nature of Fig. 1 should prevent unreliable promises being made as to the deliveries. To manufacture an article cheaply and efficiently it is necessary that every part required shall be ready when it is wanted. If details are not ready when they should be the assembling is delayed, and the organization of that department greatly diminished.

SUPPLYING MANUFACTURING INFORMATION

After the contract has been obtained it is best to determine how long can be given to the various operations such as drawings, patterns, obtaining raw material

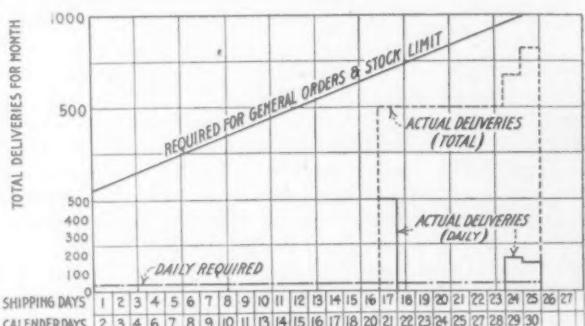


Fig. 2—A Case of Irregular Production

such as castings and forgings, machining of these parts, completion of details, assembling, testing, etc. A convenient means of doing this is to lay out a rough time table covering the various operations, starting with the delivery date and working backwards to the date of receiving the order. This is, of course, only approximate, but after taking into consideration the present condition of the works, it can be estimated from past experience how much time these various stages in the manufacture will occupy. Any surplus time can be apportioned to those departments where there is likely to be congestion.

We have now determined how long the drawing office can be given for completing full working drawings. From this a list can be prepared which is sent to the drawing office specifying when full manufacturing information for the various parts must be sent into the shops. In addition to the full working drawings, this information should consist of a detailed specification giving particulars of drawing numbers, pattern numbers, and complete details of all parts. Each department concerned in the manufacture receives a copy.

When the design is well advanced, the purchasing department will ask bids for the necessary raw material and manufactured parts. On receipt of these, the official orders will be given and these will state the date that the materials must be delivered.

PRODUCTION DEPARTMENT

The specification sheets furnished by the drawing office should pass through the production department on their way to the shops. It is the work of this department to see that all details required, whether manufactured in the works or supplied from outside, shall come

ASSEMBLING DEPARTMENT

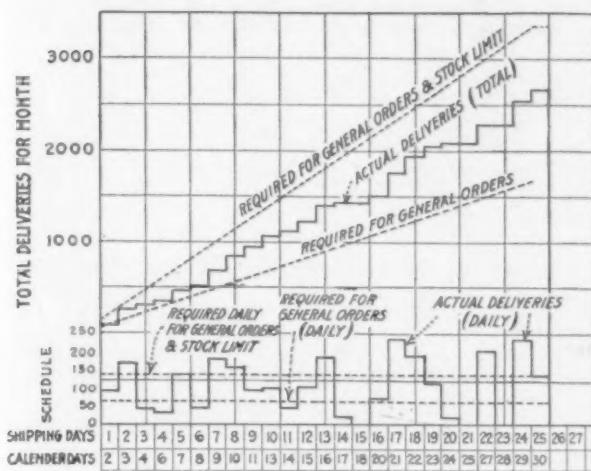


Fig. 3—Example of a Good Record

to hand when required by the machining or assembling departments. Some method must be adopted whereby all material can be traced in a systematic way, for on this will depend the satisfactory feeding of the factory.

The general time table of manufacture is based on the expected delivery of the material, and should this be much overdue the time given for the completion of the various parts must be seriously interfered with. It is therefore essential that this work shall be done well and efficiently. In any system designed to accomplish this, the aim must be to anticipate any possible cause of delay in obtaining material, whether due to lateness in ordering or delay in delivering.

It will be convenient to keep a record arranged in a suitable form enumerating in as much detail as is thought necessary those parts required for each machine. From this record the production department can see at a glance how the material is coming in, what remains to be ordered, and what requires to have pressure applied to urge forward delivery. As soon as the order is placed those columns indicating when the drawings will become due can be filled in by the aid of the rough time table already laid down. This can be used by the production department in keeping the drawing office advised of any drawings which are unduly delayed. When the drawings are complete they are forwarded to the works, via the production department, and the other columns under this heading are filled in.

When the specifications have been received by the works it is necessary to have some system whereby each foreman can at any time see what his shop has to complete and when. In the departments machining large pieces there is comparatively little difficulty, for the number of parts are few and move slowly. Probably marking the specifications with the date when each piece must be complete will prove sufficient. In detail departments, however, the parts may be small and very numerous; they may also be required at different periods. Here delays may prove serious, for the final assembling of the machine will be much delayed should any essential part be wanting when required. In these departments there must be some means of tabulating the work in hand in the order in which it is required, so that at any time the foreman will know whether he is up to date, what orders are overdue, and what amount of work is ahead. Without such an index it will be necessary for the foreman to spend a considerable time, in finding out from those departments which he has to supply, what they require at the moment and what their needs will be in the near future. Anything which can be done to obviate the absence of a foreman on this work is a direct gain in efficiency.

A convenient form in which to lay out an index of this sort is to have a book, or cards if these are preferred, so that each week has a certain space allotted to it. As the specifications are received marked with the date when the material must be completed, the details are entered concisely under the week in which they become due. As the work is completed the index is marked off, so that uncompleted items stand out conspicuously.

It is in assembling that all delays which may have occurred in completing details in the feeder departments are reflected as a much more serious delay in the finished article. If these delays are prevented the output is greater, it is assembled more cheaply, and the men work better if the supply of material is constant and is received when required. Furthermore, it is far from satisfactory and decidedly inefficient to have partly assembled machines lying about, all held up by the lack of some small part.

To prevent this the foreman naturally does not like to commence assembling until he is sure of being able to carry the work through without stoppage. He must be able to ascertain exactly how the material stands for any particular machine. This information can be obtained by referring to the specifications, which must be kept up to date as regards completed material and all stock parts which are supplied directly by the stores. The method usually employed for keeping these specifications posted is for the detail departments to forward to the assembling sections receipts for all completed materials as soon as these are handed over to the stores, some similar method also being adopted for those parts delivered complete from outside sources and for stock material not manufactured in the works.

STORES

Although the manufacturing feeder departments play such an important part in the organization of the factory, the various stores for raw materials and manufactured parts supplied from outside sources are vital to the successful feeding of the factory. These stores, too, will contain stocks of expensive materials, which should be kept down to the lowest possible limit. The storekeeper should keep a systematic record covering all items in his stock, specifying the maximum and minimum allowed, the ordering quantity and the ordering level. This record can be kept in a loose-leaf ledger or on some card index system. As material is issued the details are entered in the ledger, debiting the order number for which the material is required.

MANUFACTURING OF STANDARD APPARATUS

It has been assumed heretofore that the product is not manufactured chiefly to standard designs. When, however, the factory is employed in turning out large

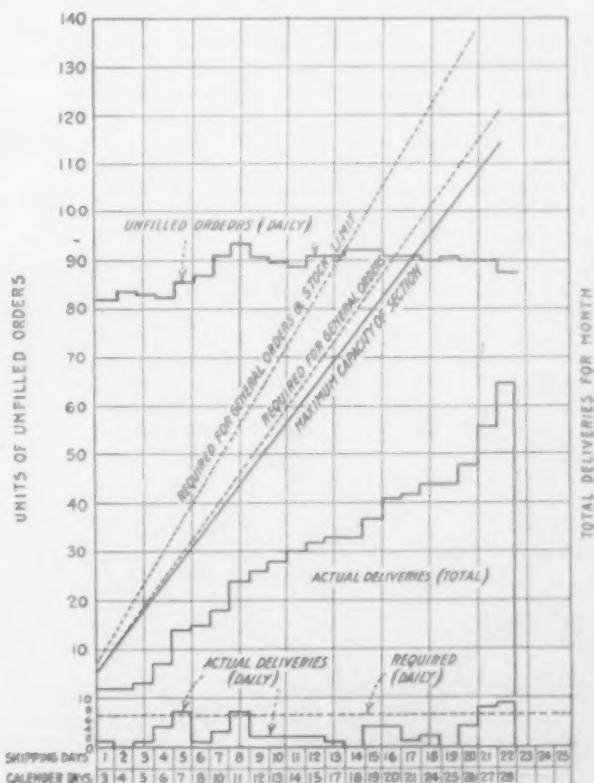


Fig. 4—Poor Assembly Record

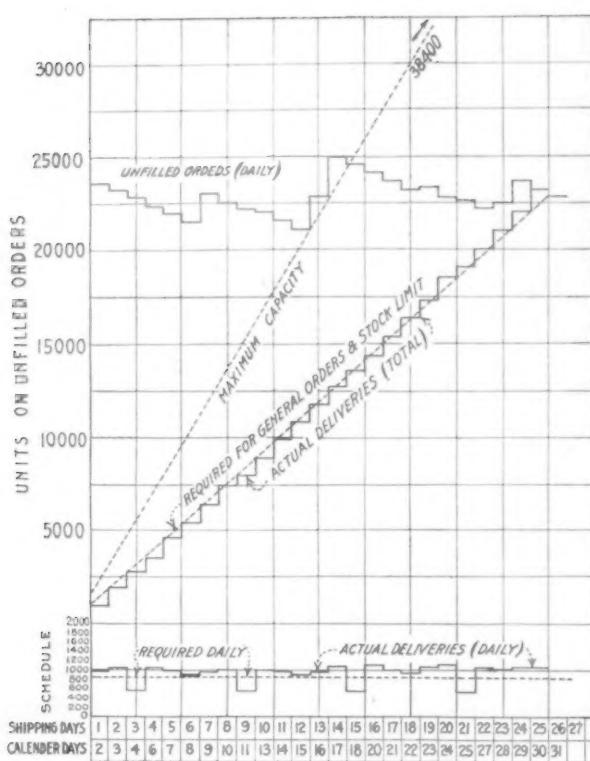


Fig. 5—Good Assembly Record

quantities of an approved design, the system may require some modifications, and possibly some elaboration which would not be warranted where the output is not standard and where the designs are frequently changing. In factories of this kind, the sales will to a great extent be made straight from a price list. Deliveries will also to some extent be standardized for any particular size and type of machine.

To obtain these deliveries it is essential that no time be lost in getting the manufacturing information into the works. On receipt of the order the designing staff will decide whether the standard machine is capable of fulfilling the requirements, and if so will pass the order on to the specification clerks to make out specifications for the works.

These specifications will probably be standardized and it will only be necessary to select those applying to the order, fill them in for the required number of machines, to forward them via the production department. The specifications, together with the detailed drawings, will constitute the entire manufacturing information. To expedite the completion of this information in the minimum time, various printed forms are used so as to save any unnecessary clerical work. To give examples of these forms and to describe their details would be of little general interest. But in any system adopted care must be taken to guard against the building up of a system of forms only, and so eliminating the human element of interest and responsibility. If such care is not taken there is a great danger of the whole system developing into so much waste paper and the work being completed before the system designed to assist in its manufacture can come into use. In such case it will be more likely to hinder than assist production.

The production department will distribute orders and specifications as previously, each being marked with the date when the various components have to be completed. In most cases a large portion of the details required will be manufactured for stock, and each feeder department will have put through these stock parts in suitable batches. This will be regulated by the production department under the supervision of some higher authority, to insure that the stock does not reach too high a level, and so tie up too much capital, or fall too low and so jeopardize the delivery of the final product.

As previously stated, it is in the assembling department that the efficiency of the works in production is best gaged. It is, therefore, well to have some method whereby the management can see whether the organization of the works as a whole is such as to insure the

factory producing the right quantity at the right time.

A large American works manufacturing all kinds of electrical machinery, and where the output of machines and accessories, all more or less standard, is large, has devised a system for accomplishing this. Graphical records are kept of the output of the feeder and assembling departments. These records, known as load diagrams, contain curves indicating for each day the total number of units on order not delivered, the number of units wanted each day, and the number of units actually delivered each day. Figs. 2 and 3 are typical curves for feeder departments, and Figs. 4 and 5 for assembling departments. Examination of these shows whether any section of the works is ahead of or behind schedule.

In addition to the load diagrams, a delivery efficiency chart is made showing how delivery promises are met. A typical case is shown in Fig. 6. On this chart are plotted curves showing the daily percentage of dates kept, the average percentage of apparatus shipped on time for the past 30 days, and the percentage of overdue orders on hand. In some cases this chart is amplified by adding curves showing the percentage of orders overdue by varying amounts such as 5, 10, or 20 days late. Copies of these charts are circulated through the works. Considerable interest is taken by the departments concerned, and a certain amount of friendly rivalry exists between them.

In such works the detail and assembling departments naturally specialize to a much greater extent in the manufacture of certain parts than in those works where the product is not so standardized. This will also entail a more systematic grouping of certain classes of machines, for the tendency is to make each detail in large quantities for stock, from which the assembling departments will draw.

From the nature of this manufacture it is obvious what an important part will be played by jigs used for these standard details. Without these jigs it would be impossible to manufacture cheaply, nor could the great advantage of interchangeability and the supply of spare parts be attained.

CONCLUSION

Whether the works are large or small, whether the apparatus manufactured is standard or special, the human element is bound to play an all-important part. No works can ever be independent of this factor. The co-operation of individuals and departments is so vital that it may well be considered as the foundation of any system.

Heads of the departments must be men of broad mind, capable of handling those under them, so as to encourage them to have real interest in their work, to treat their profession as something in which they can have real pleasure and not just as a dull monotony. The result will be that individuals in subordinate positions will gradually be found capable of taking more responsibility, so that when the time does come for the heads of the departments to move on, there will be someone so trained to carry on the organization of the department.

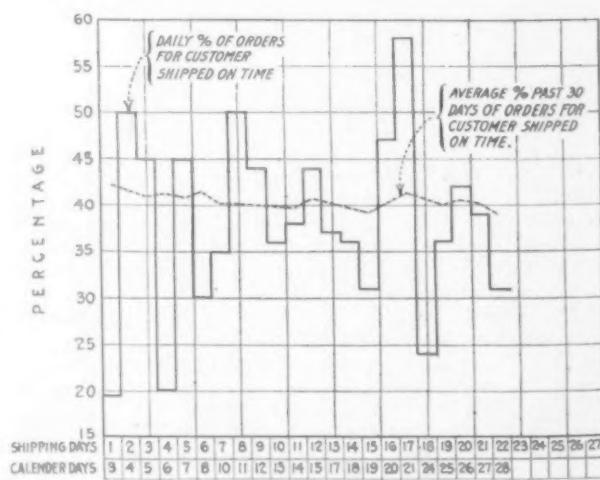


Fig. 6—Chart Showing Meeting of Delivery Promises

Much might be said about co-operation but it is so obviously necessary and it stands out so conspicuously in every walk of life, that it need only be mentioned in connection with the present question. Unfortunately, however, one often finds that individuals and departments are not worked at their highest efficiency, due to the lack of this essential. Without perfect co-operation the effectiveness of any system, no matter how good it may be, will be greatly reduced.

Disintegration of Labor and Efficiency

In an address before the American Society of Mechanical Engineers in New York on Sept. 29, on "Social Preparedness and Engineering," Walter N. Polakov, chief engineer of the Power Plant Management Company, New York City, spoke in part as follows:

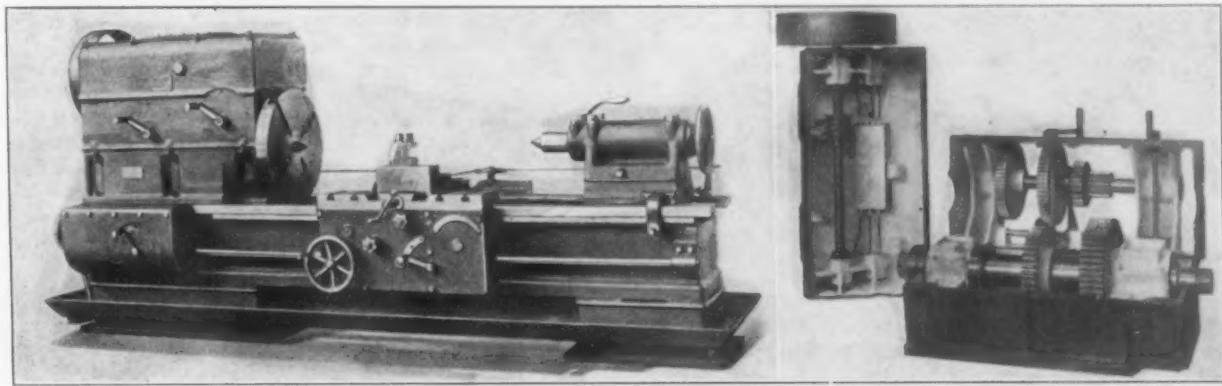
In the heat of the present struggle for existence, the European governments have been forced by circumstances to admit principles which even two years ago would have imperiled the lives of their advocates. The higher law of national self-preservation took the upper hand, and several governments resorted to the proclamation, unparalleled in history, that the industry shall serve the country, not the individuals. War profit tax is one of the evidences of this point of view. In its ultimate development, this statement means the abolition of the right to derive the profits from the

whereby the increased productivity of labor may over-tax none and secure cheap product from expensive labor. Even untrained imitators have met with a measure of success, the inefficiency being so glaring and universal. While certain parts of workmen's organizations objected to this movement for political reasons, the class conscious workman has welcomed it.

A 26-In. Heavy-Duty Engine Lathe

The Riter-Conley Company, Pittsburgh, Pa., has placed on the market a 26-in. heavy-duty geared head engine lathe. The spindle speed changes are obtained through a somewhat interesting arrangement of gears in the headstock.

The machine, as will be noted, is of massive construction, the weight with a 16-ft. bed being 16,000 lb. A high-speed pulley is employed to drive the spindle, eight changes being regularly obtained through steel gears running in oil, although in the case of the tool illustrated only four are available. The bearings in the headstock are piped to an oil reservoir in the upper part, the lubricant being supplied by a pump in the interior of the headstock. The spindle, which is of high-carbon forged steel, is 56 in. long, and is finished by grinding. It runs in bronze bearings, the front one being 6 in. in diameter and 10 in. long, while the rear one is 5 in. in diameter and 8 in. in length.



The Eight Spindle Speed Changes Available with this 26-In. Heavy-Duty Engine Lathe Are Obtained Through the Somewhat Novel Geared Headstock Arrangement Shown at the Right

socially necessary production. The reshaping of industrial relations is close at hand. To-day hardly one of the ultra-radical measures of yesterday is not realized, at least to some extent.

The real need to workmen and good to society lie in the thorough utilization of all available scientific knowledge for the perfection of such shop methods as shall result in the increased productivity of labor. Especially will the productivity of labor rise through the discontinuance of the present enormous disintegration of labor, in hundreds of thousands of petty establishments, conducted with imperfect tools. But even the large establishments could, with hardly any exception, be conducted far more rationally than now, so that, aided by the most highly perfected technical process, an infinitely larger demand could be supplied.

E. N. Hurley, chairman of the Federal Trade Commission, says: "Over 100,000 of the business corporations in the country report no net income whatever. In addition, 90,000 make less than \$5,000 a year, while only the 60,000 remaining, the more successful ones, make \$5,000 a year or more." Now, if 75 per cent of business corporations are managed not to get any profit (or not to show it) it means that they cannot progress, that they waste natural resources, that they cannot properly take care of their employees. Under such conditions the low productivity of labor is as inevitable as the efforts to exploit labor with imperfect tools and by imperfect methods. Antagonism of interests and of relations between labor and capital follows necessarily.

Engineers have been working for the last decade or two to solve this problem by means of scientific studies of working processes and devising methods

A special design of feed box is employed and 14 quick changes are provided through cut steel gears, although but three are available in the lathe shown. The tailstock is of heavy construction in keeping with the rest of the machine and a pawl engaging a rack cast in the bed is relied upon to assist in keeping it in place. A special taper attachment is provided for use in connection with shell work.

Standard Engineering Company Sold

John W. Hubbard, president of Hubbard & Co. and the National Nut & Bolt Company, also identified with other large manufacturing interests in Pittsburgh, a large stockholder in the Canton Sheet Steel Company, Canton, Ohio, and connected with other outside interests, has purchased a controlling interest in the Standard Engineering Company, Ellwood City, Pa., and is gradually acquiring additional stock in that company. The company is a large manufacturer of tube-mill machinery, rolling-mill equipment, sand and chilled rolls, pipe-threading machinery, and also a full line of gray, semi-steel, cupola and air-furnace castings. It also builds machine work to drawings. It is the intention of Mr. Hubbard to make large additions to the plant, these to include doubling the foundry capacity, while the output of the engineering department will be increased about 50 per cent. It is stated that the price paid for the plant was in excess of \$300,000, and probably close to this amount will be spent in making additions. As yet no changes have been made among officials, or operating heads, but after Jan. 1 a reorganization of the company will be made, and Mr. Hubbard will be president.

The Standardization of Machine Tools*

Suggestions Regarding Standards of Speed and Feed Series and Standardized Power for Machine Tools—Tool Posts and Lathe Centers

- BY CARL G. BARTH

The objection is often raised to the adoption of standards of any kind that standardization blocks the way for further development and improvement. If this were unqualifiedly true, standardization would almost be a crime; but if we adopt a standard merely as representative of the best a trade or profession knows of at any one time, with the understanding that as soon as a decided improvement is brought out, a new standard will be adopted to parallel temporarily and eventually replace the former standard, the danger of stagnation will be obviated.

During his many years of experience the writer had gradually been forced to see an enormous advantage in also standardizing the machine equipment as a whole, aside from the standardization of the mathe-

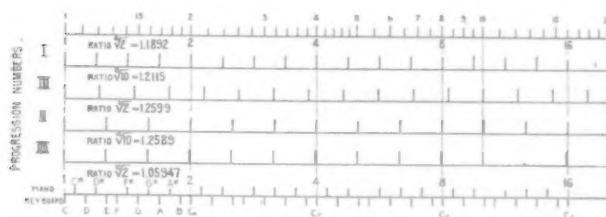


Fig. 1—Logarithmic Plot of Suggested Alternative Standards for Speeds and Feeds

matical and certain constructive features of each machine. Wherever possible his effort is to have only the very same make of machines in a certain productive group, and in the expansion of such a group to add machines of exactly the same design, even in some cases to the extent of having a manufacturer furnish what is no longer his most recent product.

STANDARD SPEED SERIES

As in the present state of the science and the art of cutting metals, it is, on the average, impossible to determine the most economical or suitable speed and feed at which to run a machine for any set of conditions closer than a certain percentage, it is now almost universally accepted that the available speeds of a machine should be in a geometrical progression. It being agreed that a geometrical series of speeds should be provided for any one machine, the writer's idea is that a universal speed series should be adopted by all machine tool builders for all machines such as lathes, boring mills, milling machines, drill presses, etc., that are provided with a spindle for either the work or the cutting tool, and which, except in the case of certain single purpose machines not included in this discussion, may be rotated at different speeds.

In 1888 the writer designed for William Sellers & Company, Inc., of Philadelphia, a large lathe which had 30 speeds in a practically perfect geometrical progression, with a ratio of a little over 1.15, obtained by a correct relation between a 5-step cone, two back-gear reductions and two forward speeds of the countershaft. Again, in 1892, he designed another with 36 speeds which had a practically constant ratio of but little over 1.14, obtained by a 6-step cone, two back-gear reductions and two forward speeds of the countershaft.

Later, in designing some special lathes for the Bethlehem Steel Company for the better utilization of the then new high-speed tools, he adopted 1.2 as a more rational ideal, and he has never since found any rea-

son for deviating materially from this ratio, though it was several years later before he recognized the desirability of an absolutely constant ratio, not only for all lathes, but, as referred to above, for all machine tools with a revolving spindle.

However, if we construct a geometric progression with this simple ratio 1.2 and beginning with 1, all subsequent terms of this will naturally be found to be anything but simple numbers, thus: 1 1.2 1.44 1.728 2.074 2.488 2.986 3.583 4.300 5.160 6.192 7.430 8.916 10.70 12.84 15.41 18.49 22.19 26.62 31.95 38.34 46.00, etc. In reality, therefore, we will have a simpler progression by slightly modifying this ratio 1.2 such that the fifth term becomes 2 instead of $1.2^5 = 2.074$, for then the whole progression becomes

$$1 \quad 2^{\frac{1}{4}} \quad 2^{\frac{1}{2}} \quad 2^{\frac{3}{4}} \quad 2 \quad 2 \cdot 2^{\frac{1}{4}} \quad 2 \cdot 2^{\frac{1}{2}} \quad 2 \cdot 2^{\frac{3}{4}} \quad 4 \quad 4 \cdot 2^{\frac{1}{4}} \quad 4 \cdot 2^{\frac{1}{2}} \quad 4 \cdot 2^{\frac{3}{4}} \quad 8, \text{ etc., or} \quad [1] \\ 1 \quad 1.18921 \quad 1.41421 \quad 1.6818 \quad 2 \quad 2.37842 \quad 2.82843 \quad 3.3636 \quad 4 \quad 4.75685 \quad 5.6569 \quad 6.7272 \quad 8, \text{ etc.}$$

with every fourth term a power of 2, the simplest of all numbers except unity itself.

If the ratio $\sqrt[4]{2} = 1.1892$ be considered unnecessarily small, a somewhat larger ratio preferred in order to obtain a larger final ratio between the slowest and the fastest speeds of a machine, with a rather limited total number of speeds, the writer's answer is that he has had in mind also, as a possibly more generally acceptable progression, one with the constant ratio $\sqrt[4]{2} = 1.2599$; that is,

1 2¹ 2² 2 2.2¹ 2.2² 4 4.2¹ 4.2² 8, etc., or [II]
 1 1.2599 1.5874 2 2.5198 3 1748 4 5.0397 6 3496 8, etc.

Again, as a compromise between progressions [I] and [II] and to favor a possible preference for a progression with 10 rather than 2 as a periodically re-



Fig. 2—Logarithmic Plot of Revolutions of Spindle Against Hardness Numbers

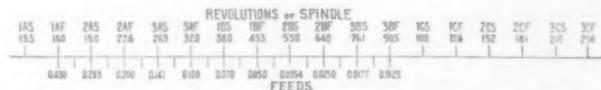


Fig. 3—Logarithmic Plot of Revolutions of Spindle Against Feeds

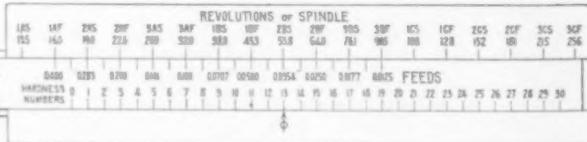


Fig. 4—Slide Rule Developed from Logarithmic Plots of Figs. 2 and 3

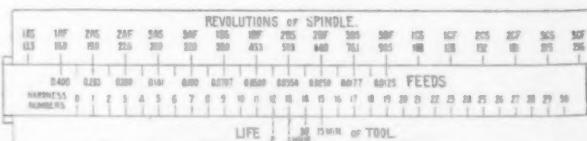


Fig. 5—Slide Rule Developed from Fig. 4 by Addition of Life Relation of Tool

*From a paper read before the American Society of Mechanical Engineers, New York, Dec. 6.

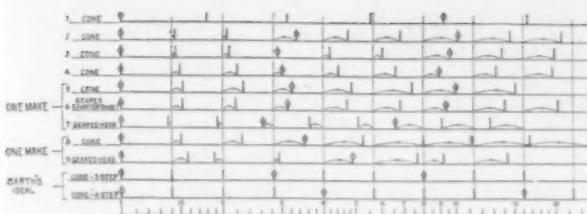


Fig. 6—Logarithmic Plot of Single Countershaft Speed Series of Nine Lathes Submitted by Different Manufacturers in February, 1914

curing ratio, the following progression may also be looked upon as a candidate:

$$1 \cdot 10^{1/2} \text{ etc., or } [III]$$

$$1 \cdot 1.2115 \cdot 1.4681 \cdot 1.7782 \cdot 2.1542 \cdot 2.6103 \cdot 3.1623 \cdot 3.8314 \cdot 4.6425 \cdot 5.6236 \cdot 6.8138 \cdot 8.2541 \cdot 10 \cdot 12.115, \text{ etc.}$$

The constant ratio of this progression $\sqrt[12]{10} = 1.2115$ is very close to the geometrical mean of the ratios of progressions [I] and [II], which is $\sqrt{21 \cdot 25} = 2\sqrt{5} = 1.224$.

Finally, a certain interesting simplicity would also be introduced by the adoption of the constant ratio $\sqrt[10]{10} = 1.2589$, thus:

$$1 \cdot 10^{1/2} \text{ etc., or } [IV]$$

$$1 \cdot 1.2589 \cdot 1.5848 \cdot 1.9053 \cdot 2.5119 \cdot 3.1623 \cdot 3.981 \cdot 5.012 \cdot 6.310 \cdot 7.943 \cdot 10 \cdot 12.59, \text{ etc.}$$

It will be noticed, however, that there is in reality a theoretical difference only between progression [II] and this progression, the tenth number (7.9431) of this being less than 0.8 of one per cent smaller than the tenth number (8) of the former.

But the best comparison of these four progressions is made by plotting them on a logarithmic scale, as in Fig. 1, on which is also plotted the progression that represents the relations between the number of vibrations of the strings of a piano, the constant ratio of which progression is $\sqrt[12]{2} = 1.05947$.

Having thus indicated that there may be a choice of standards, the writer will further on give some pretty strong reasons for favoring progression [I], admitting at the same time that under certain conditions every other term may be omitted, thus leaving the progression:

$$1 \quad \sqrt{2} \quad 2 \quad 2\sqrt{2} \quad 4 \quad 4\sqrt{2} \quad 8 \quad 8\sqrt{2} \quad 16, \text{ etc., or } [V]$$

$$1 \cdot 1.4142 \cdot 2 \cdot 2.8284 \cdot 4 \cdot 5.6568 \cdot 8 \cdot 11.3137 \cdot 16, \text{ etc.}$$

What has been said above in discussing the adoption of a standard speed series holds equally good for a standard feed series, except for the most up-to-date designs of lathes, in which the feeds for plain turning are obtained as a constant fraction of the screw-cutting feeds. For these latter it is suggested that both the cross feeds and the longitudinal feeds be made the same fraction of the screw-cutting feeds for all lathes regardless of size.

In paragraph 1134 of Mr. Taylor's "On the Art of Cutting Metals," the author gives his original classification of hardness of metals in terms of their relative cutting speeds, all other conditions being maintained uniform, thus: If 0 stands for the ideally softest grade of any kind of metal, he made class 1 represent a metal just enough harder to reduce the cutting speed by 1.1; class 2 by 1.1^{1/2}; class 3 by 1.1², etc., or by factors in the following geometrical progression:

$$\begin{array}{ccccccccccccc} \text{Class 0} & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10, \text{ etc.} \\ 0 & 1.1 & 1.21 & 1.331 & 1.464 & 1.6105 & 1.776 & 1.949 & 2.144 & 2.358 & 2.594 \end{array}$$

The writer has since modified this to

$$\begin{array}{ccccccccccccc} \text{Class 0} & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10, \text{ etc.} \\ 1 & 2^{\frac{1}{2}} & \text{etc., or } [VI] \\ 1 & 1.0005 & 1.1892 & 1.2968 & 1.4142 & 1.5422 & 1.6818 & 1.8340 & 2.2.1810 & 2.3784, \text{ etc.} \end{array}$$



Fig. 7—Simple Logarithmic-Scale Method for Getting the Closest Possible Approximation to a Given Ratio When Two Sets of Gears Are Involved

as being more rational, because then we have the great simplicity that a difference of eight hardness classes corresponds to a difference of exactly 2 to 1 in cutting speeds. It will be seen that this progression is just the same as progression [I] with intermediate terms in-

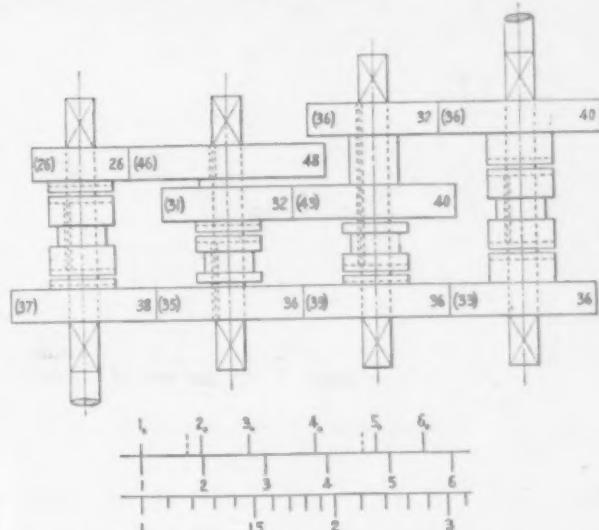


Fig. 8—Diagram of Gearing of Speed Variator of a Well-Known Make of Planer

Figures in parentheses show number of teeth in gears as made; other figures show number of teeth in gears to improve the speed series; 1_o to 6_o, logarithmic plot of original relative speeds

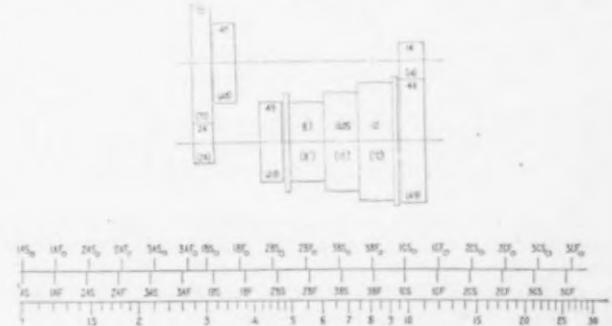


Fig. 9—Diagram of Live Head of a Well-Known Make of Lathe

Figures in parentheses show respectively the number of teeth in the gears and the diameter of the cone pulleys as made; the other figures indicate a simple change that would further improve a very good speed series: 1AS_o to 3CF_o, logarithmic plot of original speeds; 1AS to 3CF, logarithmic plot of improved series

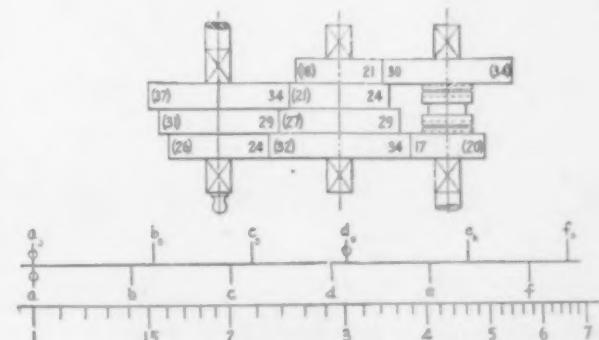


Fig. 10—Diagram of Gears in Feed Box of a Well-Known Make of Drill Press

Figures in parentheses show number of teeth as made; other figures show improved number of teeth; a_o to f_o, logarithmic plot of original relative feeds; these conform quite closely to progression [V]

terpolated, and hence the simplicity of this for a speed progression in conjunction with [VI] for a hardness scale. It would mean that a tool would last just the same length of time on two materials two hardness classes apart, if run on the softer grade with a certain speed and upon the harder grade with the next slower, as perhaps best brought out by the logarithmic plot in Fig. 2.

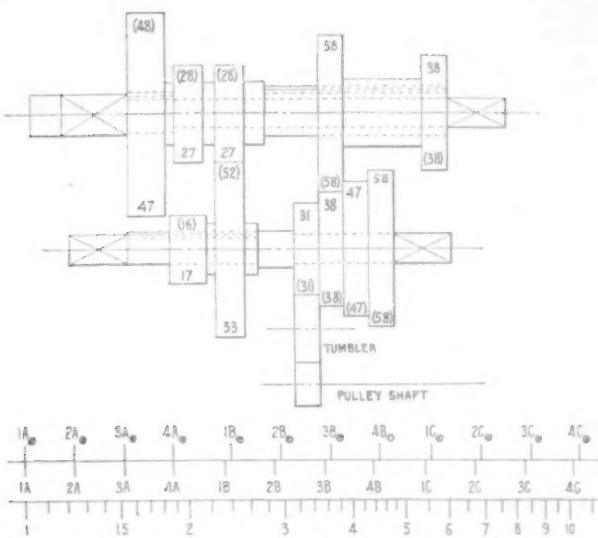


Fig. 11—Diagram of Driving Gear of a Well-Known Make of Milling Machine

Figures in brackets show number of teeth in gears as made; other figures indicate number of teeth in gears to further improve an already excellent speed series; 1A_o to 4C_o, logarithmic plot of original speed series; 1A to 4C, logarithmic plot of improved speed series

Again, in paragraph 732 of *On the Art of Cutting Metals*, it is stated that, approximately, the cutting speed varies inversely as the square root of the feed, which is a compromise between the special laws for steel and cast iron. Therefore, if in connection with a series of speeds conforming to progression [I] we also have a series of feeds in the same progression, the relation of these feeds and speeds to each other will, in order to maintain all other conditions uniform, be as represented by the logarithmic plot in Fig. 3. In general, in dropping or increasing the speed by a step at a time, we would increase or drop the feed by two steps at a time.

By combining the plots in Figs. 2 and 3, as done in the slide rule Fig. 4, we also most readily recognize that a change of one or more numbers in the hardness class of the metal cut will have no effect on the cutting speed if we meet this with a change of feed involving a corresponding number of steps, increasing the speed as the hardness goes down, decreasing it as the hardness goes up.

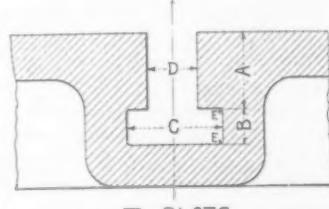
Finally, in paragraph 700 of *On the Art of Cutting Metals* is given the relation between cutting speed and

the life of a tool in cutting steel, which is that the speed varies inversely as the eighth root of the time the tool will last, all other conditions remaining uniform. Adding this relation to the slide rule in Fig. 4, we get the rule shown in Fig. 5.

Progression [I] represents a fair average of the speed series provided by certain well-known machine-tool builders in some of the machines produced by them in recent years, after they had realized that the time had come for the provision of closer speed regulation, even if this meant a considerable reduction of the ratio of the fastest to the slowest speeds obtainable. An example of this fact is represented in Fig. 6, which shows the speed ratios of nine 16-in. lathes offered by six different manufacturers in answer to an inquiry in February, 1914. One manufacturer offered three different designs and a second two different designs. It will be noted that the difference between the speed series provided in the different designs of the same maker differ as much among themselves as do the designs of different makers, except in the case of lathe No. 1, which represents the least up-to-date design. To make the diagram clearer, the speed ratios are laid out for a single forward countershaft speed only, thus showing only every other ratio of the full progression intended.

Most designers of the present day, whether mathematically inclined or not, are familiar with the use of the simple slide rule in selecting practical numbers of the teeth for a gear and pinion of a single set of gears

D	A	B	C	E
BALDIAM.	1 1/2	2 1/2	3 1/2	4 1/2
1/2	9/16	11/16	13/16	3/2
5/16	6/16	22/16	32/16	5/2
1/4	2/16	27/16	152/16	32/2
5/8	15/16	1/2	12/16	3/2
3/4	1/2	24/16	132/16	32/2
7/16	1/16	32/16	14/16	3/4
1	1/2	27/16	132/16	32/2
1 1/8	15/16	1/2	28/16	3/2
1 1/4	1/2	24/16	232/16	32/2
1 5/8	21/16	32/16	5/2	3/2
1 1/2	2 1/2	1 1/2	1 1/2	1 1/2



T-SLOTS
WITH NECK EQUAL TO DIAMETER OF BOLT.

to give a certain ratio as closely as possible; but a simple logarithmic-scale method for getting the closest possible approximation to a given ratio when two sets of gears are involved, which the writer has used for some years past, is not generally known, if indeed at all known to anybody who has not worked with the writer in connection with these matters.

This method will be fully disclosed by a single illustration embodied in the diagram Fig. 7, and we will take for our example the ratio $4\sqrt{2} = 5.6568$, with the restriction that neither pinion is to have less than 14 teeth, and that the sum of the numbers of the teeth in the one set of gears is to be 80 and in the other 60.

By means of a logarithmic scale, which is shown just below the significant part of the diagram, lay off the ratio 5.6568 from *a* to *b*. Now place the graduation point for 14 on the logarithmic scale, representing a pinion of 14 teeth, at *a*, and make a mark at the graduation point representing the gear that would be a mate to this pinion; namely, one having $80 - 14 = 66$ teeth. This operation is indicated by the logarithmic scale above the significant part of the diagram. The distance *ac* then represents the ratio 66/14. Similarly, 15 is placed at *a* and a mark made at 65, 16 is placed at *a* and a mark made at 64, and so on, as far as will eventually appear necessary. Next, below the line place the graduation point 14 at *b*, and mark off toward *a* the point for the mate for this pinion in the second set of gears; namely, $60 - 14 = 46$. Repeat for 15 and 45, 16 and 44, etc. On completion of this repeated operation we at once discover that the closest coincidence between the marks on both sides of the line *ab* is for the two sets of gears 65/15 and 34/26, whose combined ratio is 5.6667, which is less than 0.2 of 1 per cent greater than 5.6568. It will also be seen that the two combinations $59/21 \times 40/20$ and $58/22 \times 41/19$ come quite close to the required ratio.

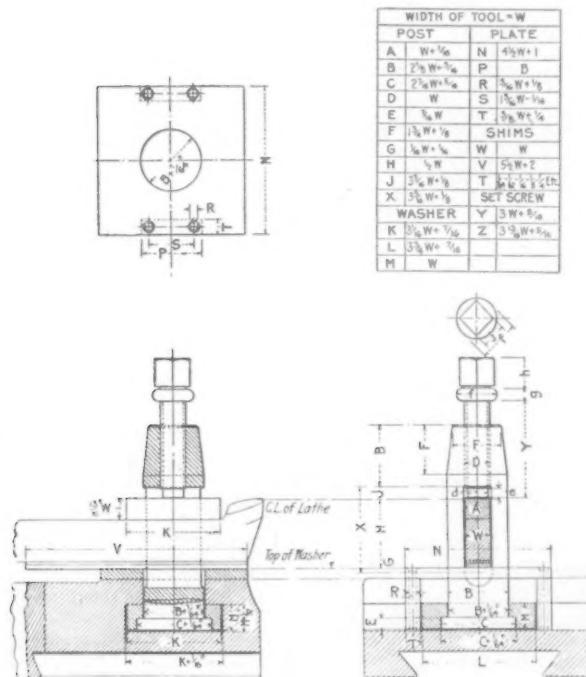


Fig. 12—Proportions Used by Author for the Swivel Form of Tool Post for Moderate-Sized Lathes

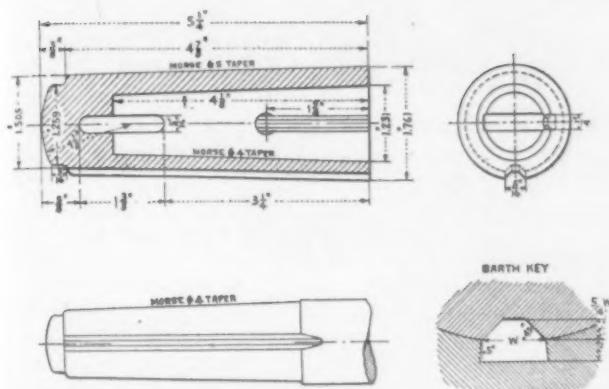


Fig. 14—Barth's Key Method of Driving Drill, Arbor and Boring-Bar Shanks

Among additional helps in arranging speed and feed series as advocated, any otherwise desirable group of gears of the following numbers of teeth will be found to lend themselves admirably for use with a tumbler gear:

Comparing these ratios with the writer's ideal progression [I], it will be seen that the deviation is nowhere greater than 0.7 of 1 per cent.

Cone gears made with teeth of any multiple of the following also give ratios differing less than 1.02 per cent from conformity with the same progression:

16	15	14	13	12	11	10	9	
—	—	—	—	—	—	—	—	—
8	9	10	11	12	13	14	15	16

2	1.6667	1.4000	1.1819	, 1	1.1819	1.4000	1.6667	2
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To further emphasize how even some fair attempts at regular progressions of speeds and feeds have fallen short of what might have been attained, Figs. 8, 9 and 10 are submitted as a few of numerous cases that have been investigated by the writer.

Fig. 11 also shows how even a quite excellent speed series may be further improved.

TOOL POSTS FOR LATHES

In On the Art of Cutting Metals, which Mr. Taylor wrote under great pressure, and in which accordingly the proper consideration was not given to certain subjects, the mistake was made of advocating cutting tools with moderate clearance angles, without at the same time calling attention to the fact that these can be used only in connection with tool posts in which the body of the tools is raised parallel to itself as the tool is ground down to a smaller height.

In Fig. 12 are shown proportions for the swivel form of the tool post for moderate-sized lathes which the writer has used as a standard for several years past. The most essential part of this, as regards size, is the width of the slot, which is for a tool body of approximately $1/30$ of the swing of the lathe over the bed, and a distance from the center of the lathe to the tool-supporting plate that corresponds to the ground height of the roughing tools shown in *On the Art of Cutting Metals*. The propriety of these propositions is decidedly open to discussion, however, particularly the latter.

An exceedingly important part of the machine equipment of a shop are the T-slots in various machines. Many years ago experiments were made by William Sellers & Co. to ascertain the strength of T-slots relatively to a T-headed bolt, and on the strength of these that company adopted a standardized set of slots, which, as later modified by the writer, have also been used by him for several years past. They are shown in Fig. 13.

LATHE CENTERS AND DRILL-PRESS SOCKETS

It is well known that the Morse standard sockets are no standards at all, but a perpetuated, laudable, though unsuccessful, attempt of years ago to establish standards. However, compelled for the time being to accept them as they are, everybody has now at least two standard tapers for sockets and shanks to contend

with; namely, the Morse and the Brown & Sharpe. The best the writer has been able to do, therefore, has been to make all lathe centers conform to a Morse standard so as to enable drills or drill sockets to be directly inserted in either spindle of certain or all lathes in a shop; and to make all milling-machine sockets conform to the Brown & Sharpe standard, with Morse drill sockets having Brown & Sharpe shanks for use with these whenever holes have to be drilled in a milling machine.

The writer unqualifiedly recommends the universal adoption of the Brown & Sharpe standards all around and the use of Morse sockets with Brown & Sharpe shanks during the change. He also recommends the universal abandonment of the tang as a means of driving. We have for years had the ridiculous inconsistency of drill makers that they still furnish taper-shank drills with the old-style tang as a means of driving, and along with this extensively advertise and sell various forms of "use-them-up" sockets for drills with the original tang broken off.

More than 12 years ago the writer adopted a modification of William Sellers & Co.'s key method of driving as a substitute for the tang of drills, arbor and boring-bar shanks. This is illustrated in Fig. 14, and differs from the Sellers method in the use of a special form of key that has become somewhat known as the Barth key. The virtue of this as a means of driving consists in its being subjected to crushing pressures only, and that it has no tendency to work out of its seat; and for a taper drill socket it has the additional great advantage over the Sellers straight key that the drill shank can be inserted rapidly without any special care.

Hassler Motor Company's New Plant

Robert H. Hassler, Inc., Indianapolis, manufacturer of automobile accessories, has completed a group of building on six acres of land at Naomi Street and the Indianapolis Union Railway Company, which will be occupied by the recently incorporated Hassler Motor Company, with \$250,000 capital stock. The company expects to have the plant in operation Feb. 1, and will manufacture a high-grade motor car of medium price. The plant was built by the Austin Company, Cleveland, and is a duplicate of extensive additions recently built by the same company for the Perlman Rim Corporation, Jackson, Mich., and the General Electric Company, Schenectady, N. Y. The general arrangement is that of one-story buildings without basements. The largest, 100 x 300 ft., is entirely of glass, steel and concrete. The company has moved four times since 1913 to procure larger quarters. Robert H. Hassler is president and treasurer; Edward D. Fouts, vice-president and director of sales; David G. Ong, secretary and general manager, and James A. Hittle, production manager.

Fuel Savings Possible with Economizers

The Green Fuel Economizer Company, 90 West Street, New York City, has compiled data showing the savings secured by the installation of fuel economizers in 26 large industrial plants. With a boiler pressure of 150-lb. gage, the saving in fuel effected was 9.26 per cent. The average results obtained in these plants were: Temperature at which gases enter economizer, 530 deg. Fahr.; temperature at which gases leave economizer, 343 deg.; temperature at which water enters economizer, 157 deg.; temperature at which water leaves economizer, 256 deg.; increase in temperature of feed water due to economizer, 99 deg. Among the plants from which data were secured were the American Iron & Steel Mfg. Company, Lebanon, Pa.; Johnston Harvester Company, Batavia, N. Y., and the American Brass Company, Waterbury, Conn.

The proper kind of stairs and stairways from the standpoint of safety are described and illustrated at some length in the second issue of what is called "Safe Practices," published by the National Safety Council, Commercial & Continental Bank Building, Chicago.

Russian Industrial Progress in War Time

National Organization of Manufacture, Particularly in Metal-Working Lines—American Opportunities When the War Ends

BY STERLING H. BUNNELL*

American manufacturers are interested to-day, as never before, in Russia as a market for their products. Great quantities of machinery and industrial supplies are being shipped to that country by every available steamer, and the demand far exceeds the ship space available. It is promised by those who know that after the war Russia will enter upon a period of remarkable industrial development, during which all kinds of mechanical appliances will be in active demand, taxing the resources of manufacturers of all exporting nations to supply the quantities wanted. The development is already under way under the pressure of war. As an indication of the possibilities of advancement under normal conditions, the record of progress since the beginning of the war is of much interest.

Russia differs from the other principal European countries in being distinctively an agricultural nation, almost devoid of manufacturing plants when the war began. In transportation facilities the deficiency is marked, for the extensive system of water routes and canals cannot make up for the lack of railroads in handling material and the products of manufacture. With bank deposits and accounts totaling nearly two billion dollars, Russia had about one-fiftieth of the proportion of railroad track to area of country, which is the average of all other European countries. The United States, just now feeling the effect of deficiency in railroad capacity at a time of intense industrial activity, is in position to appreciate to some extent the difficulties of doing business in a country where railroad facilities exist only along a few favored routes, while large regions have no track connections whatever.

WAR ORGANIZATION OF INDUSTRY

In starting on the upbuilding of industries to meet the immediate needs of war, co-operative action typical of Russian methods of work took the prominent part. A committee of war industries was formed by leading men, mostly residents of Moscow, for the direct purpose of developing the manufacture of munitions in Russia. About the same time the Union of Cities and Zemstvos of all Russia was organized, with the purpose of aiding the wounded. This union gradually extended its field until its work embraced the production of war material of all kinds. The union took orders from the war department for materials needed, and provided plants and organizations to produce the goods. It also took charge of important special work, such as the removal of plant equipment and valuable supplies from invaded portions of the empire. Up to the beginning of 1916 the union had built a number of complete manufacturing plants to supply the most urgent needs of the country. These needs were not all for materials required at the fighting front, but included many commonplace articles formerly imported from Germany and Austria and not made in Russia. Among the factories provided by the Union of Cities and Zemstvos

of all Russia are a bureau of standards, measuring-instrument works, benzol plant, needle factory, telephone instrument works, surgical instrument factory, and several plants for the production of chemicals.

Building factories was, however, only the beginning of the work. It was an even greater task to find the workers to operate them. In January, 1915, one-fifth of all Russian factories were shut down entirely, and the rest were 30 per cent undermanned. The principal cause of short production was lack of fuel and raw materials, caused mostly by inadequate transportation, which again hindered shipment of finished goods. The production of oil and all minerals decreased at first, the latter from lack of mine labor. Russian miners work in the country at farm labor in summer, and in the mines only in winter, so that mining and agriculture are competitors for the same hands. Pig-iron production decreased at first, but later the employment of prisoners of war and of women and children helped to bring up the output to normal figures.

METAL INDUSTRIES OF THE URALS

In the Ural districts the mining and metal industries have been able to show a small increase in production from the first of the war. This is due to the fact that foreign capital had been obtained for development, and extensive improvements were already in progress. In consequence, reduction of output due to loss of labor and other causes was offset by the increasing output of new plants. The metal industries of the Urals are already of great importance. As an indication, the Organization of Representatives of Metal Industries is open only to concerns having capital stock of \$5,000,000 or more and employing upward of 1000 men. There is unlimited room for further development of mineral industries in the Urals and elsewhere in Russia, and the demand for equipment will be enormous.

When the war began, the chemical industries of Russia were completely in German hands. Most of the factories were branches of German corporations and all depended for technical talent on German chemists and engineers. This condition has been changed so that Russian factories produce chlorine, bromine, iodine, sodium salts, bisulphite of ammonium, and chloroform and other anaesthetics. Chemical companies have increased in number, and the average capital has increased from \$200,000 in 1913 to \$600,000 in 1915. There has been a great increase in the number and output of by-product coke plants and of benzol, toluol, and other chemicals, and many new plants are under construction.

FARM LABOR DRAWN TO FACTORIES

Agriculturally, the lack of new farm machinery and of repairs and replacements for that already in use is causing a serious decrease in the production of farms. The cereal crops of 1914 were of normal amount, and the quantity was maintained in 1915 by greater productiveness of the smaller area of land worked. But in 1915 the autumn sow-

*Chief engineer R. Martens & Co., Inc., New York.

ing of rye was far short of normal, and the spring sowing was even less. Farm labor was short 31 per cent in 19 departments in the year 1913, and decreased progressively to 70 per cent short in 43 departments in 1915. This deficiency was not entirely caused by enlistment in the army. The high wages paid in cities by munition factories caused many men to leave the farms for the shops. In the region of Moscow, before the war, about one-fourth of the laboring men were employed in farm work, but in 1915 the proportion had decreased to one in twenty. Undoubtedly the lack of the usual imports of farm machinery has worked with the increase of factories for war materials in decreasing the proportion of farm labor to factory labor.

Of all countries in the world, Russia would seem most able to provide its own food. But as the facts show that even the deficient factory equipment of Russia has taken more men from agriculture than can be spared from the business of producing food, it is not difficult to appreciate how the tremendous industrial development of the United States has resulted in food shortage in every direction. There is a real world famine, though fortunately not of starvation proportions, in most countries. As the food is not there to be eaten, some or all must eat (or waste) less than in other times.

The close of the war will give opportunity for the Russians to import large quantities of harvesting machinery, machine tools, railroad supplies and factory equipment. The shortage of all these will then be acute, so that American stocks for immediate delivery will command good prices. But it must not be forgotten that to make a sale the goods must be brought to the attention of the buyer. The names of American manufacturers, so familiar to all of us, are as unknown to the Russians as the names of their great works are to us. How many readers of this article recognize Vseobshaiia Kompania Electrichestva as our own General Electric Company in Russia? The barrier of language cannot be overlooked in preparing for Russian business. The best evidence of Russian intention to buy largely in America is perhaps in the promise of Russian importing houses, which have established organizations in the United States to study American resources and bring them to the attention of Russian buyers even while the business is almost at a standstill from lack of sufficient shipping.

Continuous Plating and Cleaning Outfit

Patent rights on a machine which accomplishes automatically or mechanically all the movements heretofore performed manually in the still plating process have been acquired by the Munning-Loeb Company, Matawan, N. J. The machine, which is being offered to the trade for the first time, it is pointed out, can be applied to any plating plant, and among the advantages claimed for its use are an increased output and a greater uniformity of deposits.

The machine consists of a series of tanks containing the cleaning, rinsing, dipping and plating solutions arranged in the form of an oval about 50 ft. long. A carrier system, consisting of two endless chains driven through sprockets by a $\frac{1}{2}$ -hp. motor and carrying a series of vertical rods from which the work is hung on racks such as are shown in foreground is located above the tanks. Each rod is moved forward, raised or lowered at predetermined points by a simple cam mechanism. This arrangement is relied upon to pass the work through the different baths, raising it over the dividing walls between adjacent tanks and lowering it into the baths in the proper sequence of operation, the completed work being finally delivered at the starting point on the right of the machine.



The Small Metal Articles to be Plated Are Placed on the Metal Racks Shown in the Foreground Which Are Attached to the Vertical Rods and Are Lowered Into and Raised from the Various Plating and Cleaning Tanks Automatically by a Cam Arrangement

The movement of the work, it is explained, provides the agitation of the plating bath that permits current densities in excess of those possible in still tank plating to be employed without danger of burning. This fact, together with the elimination of handling, produces the economy of time that is a feature of the apparatus. The speed of the machine is fixed by the foreman of the plating room to give the best results, thus definitely determining the time of immersion in the various baths.

The number of standard units in the assembly of the machine and the arrangement of the tanks and lifting cams can be modified as may be desired to meet any unusual requirements. A speed ratio of 3 to 1 is provided and if conditions require this can be made even greater. The speed of 2 ft. per min. is recommended for ordinary plating conditions, which means that the work will complete the circuit of the tanks in approximately 1 hr. which, it is pointed out, is sufficient for all cleaning baths, rinses and dips, in addition to the actual plating. If light deposits are desired, the speed may be increased and the time reduced, a slower speed and a greater time in the baths, of course, producing heavy deposits.

Pig-Iron Exports Growing Rapidly

Pig-iron exports in September were 64,122 gross tons and in October 101,756 tons, both of these figures exceeding those for any previous month. To Oct. 1, 1916, the total was 302,504 tons against 156,939 tons to Oct. 1, 1915, and 92,014 tons to Oct. 1, 1914. Adding the October exports brings the total to Nov. 1 to 404,260 tons or 40,426 tons per month. In 1913, the record year, the monthly export rate was only 23,137 tons. The total to Nov. 1, 1916, is 126,612 tons in excess of the total for all of 1913.

The Superior Shipbuilding Company, Superior, Wis., will start work at once on an order for four ocean freighters for Norwegian owners. The boats will be 261 ft. long, with a beam of 43 ft. and depth of 20 ft.

The Kilby Frog & Switch Company, Birmingham, Ala., has increased its capital stock from \$150,000 to \$200,000, and will make additions to its plant.

Labor Shortage Affects Navy Yards

Government Working Program Curtailed — Standardizing Specifications for Material—Larger Stocks Planned

WASHINGTON, D. C., Dec. 19, 1916.—The shortage of skilled labor in the shipbuilding trades is seriously affecting the progress of construction work in the Government navy yards and constitutes a very embarrassing factor in the problem of expanding the yards according to the recently adopted policy of the department to equip eight yards for the construction of warships, according to the annual report of Admiral Taylor, chief of the Bureau of Construction and Repair. Important recommendations are embodied in the report respecting the standardization of all forms of material purchased by the Government and urging a large increase in the stocks on hand of construction material and equipment. The experience of the department, as frankly stated by Admiral Taylor, is not encouraging as to the success of the department's expansion policy, and the difficulties encountered by the Bureau of Construction and Repair during the past year furnish official confirmation of the statements so frequently put forward of late by private ship-builders as reasons for their inability to meet the views of the department with regard to the cost of constructing warships and the impossibility of making deliveries as in the past.

PRIVATE PLANTS BID FOR LABOR

The greatest difficulty, Admiral Taylor says, has been found in avoiding serious delays in the construction of all the vessels now being built in Government yards, due to the abnormal conditions existing in both the material and labor markets. There is available only a limited number of skilled men in the shipbuilding trades, and as these were in great demand in the various private establishments, where an unprecedented volume of merchant tonnage was under construction, it proved impracticable to obtain men to increase the navy yard forces to the point warranted by the large amount of work in hand. In fact, it has been hard to avoid serious depletion of the force already employed, as the opportunities existing in private plants for increased earnings through overtime work form an inducement which goes far to offset other advantages possessed by Government employment. This condition promises to become more acute when the large volume of work involved in the new naval program is taken in hand, as there appears to be no reason to look for a decrease in the demand for additional new tonnage for the merchant marine.

Several yards have had difficulty in pushing new construction work on hand, Admiral Taylor says, without interference with work of repair and maintenance of the active fleet in commission. It is hoped that conditions as regards the matter above will improve, but the bureau does not anticipate material improvement during the next 18 months, and during this period additional new construction work must be undertaken at the yards with great caution and the recognition of the probability of delays in case such a step becomes necessary.

SIMPLIFYING SPECIFICATIONS

Concerning the work of the bureau in the standardization of materials purchased by the Government, Admiral Taylor says:

"The activities of this division of the bureau have, as heretofore, been constantly directed toward the standardization of specifications and of materials as to quality, grades, sizes, etc., carried by the principal navy yards for work under this bureau. This standardization is essential if an adequate stock of all materials necessary to ship repairs and alterations is to be on hand when needed. Other bureaus of the Navy Department have been freely consulted in the prepara-

tion of specifications for materials used by more than this bureau. Effort has been constantly made to simplify and standardize the several requirements of the bureaus into an identical specification for all bureaus rather than a number of similar specifications with minor and unimportant differences resulting in a higher unit cost for materials of essentially the same grade and quality. Such multiplicity of specifications also gives confusion to prospective bidders in differentiating between the several similar grades of material as well as entailing an unnecessarily large variety of stock in small amounts of essentially the same materials.

"Improvements in specifications have been made possible by experience gained in actual work, by a close observation through the bureau's inspection force of outside commercial manufacturing practices and purchasing methods, by active participation by the bureau's representatives in the activities of the principal engineering and technical societies, and by utilizing whenever possible the services and technical knowledge of other expert departments and bureaus of the Government, such as the Bureau of Chemistry, Bureau of Standards, the Forest Service and others.

"In all of its relations with manufacturers and contractors the bureau has endeavored, when possible, to give accurate and prompt information when asked as to the reasons for the technical requirements of specifications and, by properly preparing its specifications and requirements, present proposed purchases in such a way as to make the navy business attractive to desirable manufacturers and to secure the broadest competition on a sound basis with consequent low costs."

LARGER STOCKS TO BE CARRIED

Experts of the Bureau of Construction and Repair have become convinced that one of the most serious handicaps that would be experienced in the event of a national emergency would be the difficulty in obtaining immediately the materials necessary to prosecute the greatly increased amounts of work that would be thrown into the navy yards, including, in addition to work on naval vessels, the alterations, repairs, etc., necessary to be made on merchant vessels which would be taken over by the Government for use as auxiliaries. This bureau has actively co-operated with the Bureau of Supplies and Accounts during the last year to materially increase the amounts of stock materials carried at the yards, particularly with regard to industrial stock used by this bureau in work under its cognizance, such as structural plates, shapes, rivets, wrought iron for the manufacture of the larger chain cables, and in equipment not ordinarily readily obtainable in the open market, such as chain cable, anchors, wire, manila and hemp for the manufacture of rope, cables, etc.

Throughout the year the high prices of materials, and in special cases, their scarcity as well, has impressed upon the bureau the soundness of the policy of carrying a much greater stock of the principal materials and supplies than has been the past practice, not only those materials ordinarily used by the Navy Department in times of peace, but also such as may become necessary to use in event of extraordinary conditions. When such stocks have been established it will be less necessary to purchase considerable amounts of material at exorbitant prices when market conditions are abnormal and delays incident to inability to get certain classes of material can be avoided. With such large stocks generally carried and properly standardized advantage can be taken of favorable market conditions for purchasing in replenishing depleted stocks.

Admiral Taylor's recommendation with regard to stocking up on material will appeal strongly to Congress and will no doubt result in the authorization to the department to go into the market for large quantities of materials at such time in the future as substantially lower price levels may be reached.

Due to outside business conditions that have prevailed during the year, Admiral Taylor says, it has been necessary to increase materially the output of the yard manufacturing plants in many directions. Progress is steadily being made in the standardization of articles manufactured and in the improvement of the mechanical processes involved. Considerable additions to the plant equipments of the several navy yards have been made throughout the year to outfit the yards not only for peace time work, but also to provide them with facilities for handling the larger operations involved in repair work to vessels that would become necessary in the event of a national emergency.

DESIGNS FOR SUBMARINES

Admiral Taylor foreshadows the early standardization of complete designs for submarines by the Bureau of Construction and Repair. Last year a design for a fleet submarine was prepared and issued to bidders, but no bids were received thereon, the contract being awarded on the basis of a bidder's design. This year, however, the naval bill contemplated the inclusion of three submarines of about 800 tons, this being the size recommended strongly by the Commander of the submarine force. The design of one of these vessels has been practically completed by the bureau and it is the intention to build this vessel in a navy yard. The other two 800-ton submarines have already been contracted for in private yards. Work on all these vessels will be rushed with a view to obtaining from the results of their trials data in regard to the comparative value of the different types with a view to the selection of that which is likely to prove most efficient under service conditions.

W. L. C.

Producing Brass and Bronze Die Castings

To overcome the limitations then existing to the universal application of die castings to general engineering practice, the Doehler Die-Casting Company, Brooklyn, N. Y., at the beginning of 1913, began a series of experiments. The work undertaken by the engineering and metallurgical departments of the company was divided into four branches, the improvement of the zinc alloys then in use, the elimination of air holes, the die casting of aluminum and its alloys and the die casting of the higher fusible copper alloys such as brasses and bronzes.

The elimination of the air holes occurring was brought about, it is stated, by a careful study of gating and venting conditions. As die castings are made by forcing metal into a steel mold under high pressure, it follows that air cannot pass through the mold, which, it is pointed out, results in air being trapped unless vents are provided in the die, since the metal chills almost as soon as it enters the mold. A considerable number of experiments was required to produce, for example, uniformly solid bearing castings.

In January, 1914, the experiments had proceeded far enough for the company to exhibit die castings made from virgin aluminum and 8 per cent electrolytic copper.

The final stage in the process has been reached, it is now announced, and at the present time commercial brass and bronze die castings, which will be marketed under the trade name of Do-Di castings, have been made. The castings produced by this process are made from yellow and red brasses and phosphor, aluminum and manganese bronzes.

The Western Drydock & Shipbuilding Company, Fort William, Ont., has closed a contract for the construction of 8 steamers, 6 ocean-going and two 600-ft. Great Lakes freighters. The capacity of the plant is to be doubled.

Electric Pig-Iron Production in New Zealand

Electric furnace pig-iron production in New Zealand is being looked into by the authorities and the chief electrical engineer of the government has made a report. Iron ore and water power are plentiful. Referring to electric smelting in Sweden the report says:

Where water power is cheap and where a special grade of iron is produced [in the blast furnace] from pure ores with the use of charcoal, electric smelting is cheaper than the blast-furnace smelting. . . . On the contrary, where low grades of ore only are obtainable (and this applies to the vast bulk of ore in the world), and where coal is cheap, and where the demand is such that pig iron can be produced on a large scale at the rate of 700 to 2000 tons per week per furnace, electricity has not a hope of competing with the blast furnace. That is to say, where pig iron has to be produced of ordinary every-day quality from average quality of ore, a blast furnace is unrivaled.

For remelting and refining iron, electricity is coming into general use at a very rapid rate. It is also being used at a rapidly increasing rate for foundry purposes, and is especially adapted for this class of work, as it will deal with a greater variety of material than the ordinary converter in use in foundries and engineering works is capable of doing. Another use to which the electric furnace is being put very largely is for reheating and annealing purposes, and it has a special field all its own in the production of special alloys of iron which cannot be produced in any other way, or not so economically.

As regards New Zealand, the report further states, the two principal sources of iron are the Parapara iron and the Taranaki iron sands. The Parapara ore is of medium quality as regards the iron content, and can probably be more economically produced and smelted by the blast-furnace process as long as coke is available in New Zealand. As regards the Taranaki iron sands, there exists here a source of considerable industry which will be developed in time for making special pig iron in which titanium will play an important part, and also for the purpose of making alloys of iron and titanium for special purposes, and, given a demand for special pig iron and for ferrotitanium alloys, these could be more economically produced from the iron sands by means of an electric furnace than by the blast-furnace process. The reason of this is that the fine grains are not suitable for use in a blast furnace, because they tend to choke the furnace, and also are liable to be carried away by the blast. Consequently some form of briquetting has to be adopted, which adds to the expense, and moreover does not permit the blast furnace to work at its best advantage.

Fabricated Steel Work in November

The fabricated steel work put under contract in November amounted to 78 per cent of the capacity of the bridge and structural shops of the country, or close to 135,000 tons, according to the records of the Bridge Builders and Structural Society collected by its secretary, George E. Gifford. This compares with 77 per cent for October. In the period from and including March, 1915, when the improvement after the shock of the European war was first felt, to and including May, 1916, or a period in which there was a considerable amount of plant extension, contracting was done at the rate of 138,500 tons per month. Thus in the last two months the contracting has been done at nearly as high a rate. In the four months of June, July, August, September of this year, following the brief spell when buying from foreign sources fell off momentarily and when high prices began to count, the engagement of bridge and structural shops averaged about 95,000 tons.

J. Winfield Reed, receiver of the Standard Sheet Metal Mfg. Company, Washington, Pa., will sell the plant at auction, Jan. 11, at 1:30 p. m. The property consists of over two acres of land on which is a concrete and steel building equipped with machinery for the manufacture of sheet-metal goods, stated to be in good repair and ready for operation.

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Co-operation in Readjustment

In referring to the address of Chairman Hurley of the Federal Trade Commission at the May meeting of the American Iron and Steel Institute in New York, it was said in these columns:

When Commissioner Hurley tells us, and with good reason, that a study of the methods of the European steel syndicates "will suggest to us methods of meeting this competition successfully," the inevitable destination of his logic is some form of regulation of prices and output at home.

Mr. Hurley had been telling the steel manufacturers in attendance at the meeting how successful the European steel syndicates had been, and in describing the procedure of the different organizations he had told how they "pooled their forces" or "combined" or "had an agreement" or "organized and co-operated." In view of these very effective organizations among the foreign competitors of American manufacturers, the Federal Trade Commission has been actively supporting the Webb bill and has argued that Congress never intended the anti-trust act to "prevent Americans from co-operating in export trade for the purpose of competing effectively with foreigners, where such co-operation does not restrain trade within the United States and where no attempt is made to hinder American competitors from securing their due share of the trade."

In commenting on Mr. Hurley's address we pointed out the well-known fact that the success of the steel syndicates of Europe which are held up as patterns is due largely to their ability to maintain in their domestic markets higher prices than those at which they sell for export. It was added that these syndicates would consider government permission or even encouragement of combination for exports a doubtful gift, if with it came government prohibition of co-operation in the home trade. The same observation is pertinent now in view of President Wilson's full committal to the Webb bill, so that as he puts it our manufacturers may have "a free hand in the matter of combined and concerted effort" to extend the export trade. He would clear away "all legal obstacles and create a basis of undoubted law for it [foreign commerce] which will give freedom without permitting unregulated license."

What essential difference in its moral aspect is to be found in the conduct of American manufacturers when combining in the interest of the nation to extend our foreign trade and their conduct in so acting when the exigencies of domestic trade require such concert? The question of some form of co-operation in domestic industry to bridge over the period of world-wide readjustment following the war is certain to come up for decision at an early day.

The steel industry in the warring countries has been the most active in the past two years and will come to the end of the war nearer its normal strength and better equipped for international competition than any other. It is not too soon, therefore, to consider what steps the steel manufacturers of the United States will take, when war demand ceases, to insure an orderly readjustment of prices to conditions then prevailing and of production to consumption in the period of uncertainty that is known to be ahead, and of which the least determinable factors are its beginning and its duration. What way can be found, if any, of applying the Supreme Court's "rule of reason" in the regulation in an industry of conditions that might prove disastrous and of realizing at the same time what the President describes as "freedom without permitting unregulated license." There is no authority granted the Federal Trade Commission in such matters, it is true. But if public sentiment is really to be the arbiter—and that is the basis on which official investigations of important labor disputes are undertaken—there are possibilities of very important public service in a Trade Commission investigation of the procedure of manufacturers who set out to plan together for the proper conduct of their industry in a trying time.

It may be expected that the Supreme Court decision on the Steel Corporation dissolution suit, in which the Gary dinner movement was made by the Government counsel to be the climax of the corporation's offending, will go farther than that court has yet gone in saying how far business men may act in concert for the good of their industry. If it does not, then steps should be taken to clear away not only the legal obstacles to which the President directly refers in advocating the Webb bill, but also those logically involved in his plea, such as an attorney general might invoke to prevent co-operation at home for the welfare of domestic trade.

There will be abundant concert in Europe after the war. It will be found among business men in the same country and among countries having mutual interests—all operating against American trade extension abroad and for a larger entry of foreign products into this market. In such a time it is only folly to allow the Sherman act to stand as it is, making a fetish of its vagueness, and penalizing at home the very procedure which our Federal Trade Commission finds to have worked wonders for industrial Germany.

The Mind and the Market

The famous "law of supply and demand" in the making of markets really works through a tortuous course. Dealings are in goods in various stages of manufacture, and even the oft-cited "ultimate consumer" is frequently found to be an elusive individual. Is the railroad the ultimate consumer of steel rails, or is the consumer the one who ships foodstuffs, or the one who eats the foodstuffs, or the employer of the man who eats the foodstuffs?

To seek for the real consumptive demand, the demand of the ultimate consumer, is, on the whole, a fruitless task. At the other extreme there is for a specified commodity the actual expressed demand of the buyer, of the man who inquires as to the price of the commodity and indicates a willingness to buy it. That demand may have, and usually does have, but a remote connection with the ultimate consumption of the commodity or the goods made from it, if, indeed, the ultimate consumer can be found at all. It is for the prospective buyer to determine by his own mental processes, equipped with various items of information, what his demand really should be. Thus it is what is in the minds of men that determines the specific demand for a commodity at a given time.

If the decision of the possible buyer rested exclusively upon consideration of material things, of physical conditions, his expressed demand would be in direct and exact relation thereto, but this is very far indeed from being the case. Both buyer and seller endeavor to determine what is in the other's mind, as well as what is in the mind of competitive sellers and buyers.

Thus the market is made by the mind, and the mind is controlled by many influences other than those resting upon physical conditions. When physical conditions change rapidly the market is apt to fluctuate even more widely, because the mental appraisement diverges widely. For instance, the breaking out of the European war saw an advance in pig tin from 31 cents on July 30, 1914, to 65 cents on August 7, eight days later, on the assumption that it might be impossible to ship tin by water to the United States. Spelter advanced from 4.82½ cents, St. Louis, on July 30 of that year, to 5.95 cents on Aug. 27, on the assumption that large quantities of spelter would be shipped out of the United States by water. These market movements were not due to physical conditions, for it could not reasonably have been expected that it would be impossible to ship tin by water and easy to ship spelter. On Sept. 25 following, pig tin returned to 31 cents, while on Nov. 4 spelter returned to 4.82½ cents. The subsequent advance of spelter

to 25 cents, in the following June, was due partly to physical conditions, but in considerable part to the mental appraisement, subsequent events showing that the appraisement was too high.

The iron and steel markets, as traced by the movement of prices and the daily or weekly turnover in actual tonnages, cannot be read aright unless very full allowances be made for the influence of the mind upon the market. The fluctuations in the volume of business from time to time since the beginning of the war, and the greatly varying rates at which iron and steel prices have advanced from time to time, have occurred chiefly through varying mental attitudes. The change in physical conditions has been practically continuous.

As a suggestion for the future, therefore, it is well to consider how far from a steady course the movement in the iron and steel market has been. Ordinarily pig iron and finished steel prices move together as to direction. Finished steel prices began to advance in January, 1915, but pig iron fluctuated, and during six months of advancing steel prices scored no general advance whatever. In the closing months of last year there was a rapid advance, to be followed by a practically stationary market for the first seven months of this year. Since Sept. 1 prices have been advancing much more rapidly than they did a year earlier. There are no conceivable physical conditions which could change in such manner as to comport with this course of the market.

In finished steel prices there were moderate, almost halting, advances during the first nine months of last year. For six months thereafter prices advanced very sharply. Then, during four months, they advanced very slightly, while in the past four months, beginning with last August, they have again advanced very sharply. As to the volume of business, the Steel Corporation's unfilled obligations decreased 20,000 tons in August, 1915, increased 1,000,000 tons in the following November, decreased 300,000 tons last June and increased 1,000,000 tons last November. The wide variations from time to time in the rate of price advances, and in the volume of buying, did not agree with any conceivable changes that could have occurred in things material. The fluctuations were due chiefly to changing judgments.

The advent of the war plunged industry in the United States into still deeper depression than had previously existed, and while physical conditions improved and the financial fabric was made sound by the establishment in November, 1914, of the Federal Reserve System, the building up of confidence was very slow. Under date of July 15, 1915, THE IRON AGE market summary said: "July developments have gone so far to strengthen the situation that steel manufacturers now speak with assurance concerning the remainder of the year"; but the steel industry was then operating only at 90 per cent of its capacity. The war was then nearly a twelvemonth old. On Sept. 23, when the war was only two months older, came the first reference to "scarcity," the phraseology being "special influences that have produced a scarcity of steel." During the following six months steel prices advanced by leaps and bounds. The war was simply proceeding. There was a new physical condition, that

the steel mills were filled with orders beyond their capacity, but they became so well filled chiefly because it had been concluded that steel might become very scarce.

At one time a combination of circumstances and views makes men buy freely. At another time a combination, and perhaps a chance combination, tends to make them leave off buying. It was probably no chance coincidence that the great steel-buying movements of 1909 and 1912 both ended at the close of the respective years. The holidays always bring a lull, and that influence, acting in the same direction with other influences, brought about a change in the general market trend.

A buying movement such as has occurred lately is certain to spend its force, either by business being placed so far ahead that still later deliveries cannot be considered, or by prices going to such a level as to make buyers pause. Fortuitous circumstances help to delay, or to hasten, such a pause. At this time we have the German peace proposal, which has made men stop to think that the war certainly will end some time, a mental operation which could have occurred at any earlier time, but did not, and we have also the advent of the holidays. Here is an unusually strong combination of influences upon the minds of men, tending to reduce the market activity. Physical conditions are certainly of minor consequence at this time. If, next month, activity is resumed at the pace of the past few months, or at that of a year ago, the resumption will be due to physical conditions taking control.

Extent of Automobile Ownership

While the growth of the automobile business is the subject of frequent comment, it is, nevertheless, interesting to note what an automobile authority gives as the present status of automobile use in this country. President John N. Willys, of the Willys-Overland Company, addressing the Association of Life Insurance Presidents Dec. 14, at the Hotel Astor, New York, stated that 10 years ago there were only 120,000 automobiles in the United States; in 1912 the 1,000,000 mark was passed; on Dec. 1 of this year the total number was 3,352,000, representing an approximate value of \$2,000,000,000. When it is considered that the automobile industry is practically less than 20 years old, these figures are staggering. Not only is the growth of the business one of the marvels of the age, but the steadily accelerating vigor of its growth has been even more marvelous. Frequently, especially in periods of business depression, the subsidence of what has often been termed "the automobile craze" has been predicted. These predictions have so far been set at naught. Possibly at some time the production of automobiles in this country may exceed the demand and the industry will then go through a period of depression, with reorganization on a different basis, but it must be admitted that no indication of such a condition is yet apparent.

The office of the Grant Iron & Metal Company, Detroit, Mich., dealer in scrap material, is now located at 1821 Dime Bank Building. The company maintains its yard at 300 Franklin Street, as heretofore.

Second Koppers By-Product Coke Plant in Canada

The Dominion Iron & Steel Company, Sydney, Nova Scotia, has closed a contract with the H. Koppers Company, Pittsburgh, for the construction of 120 Koppers by-product coke ovens, together with a Koppers by-product plant for the recovery of tar and the manufacture of ammonium sulphate. These ovens will be similar in every way to ovens recently built in the United States, except that they will be reduced in width and will take but 11.4 net tons of coal per charge. This narrower width is to adapt the oven to the high volatile coal to be used. The Dominion Company now has in operation a by-product coke oven plant, consisting of 400 Otto ovens and an Otto by-product recovery plant. The new installation will be a separate plant from the Otto installation, and will be complete in every respect. It will be intended for the production of blast-furnace coke for the company's own furnaces and will use the company's own coal, mined in Nova Scotia. This is the second by-product coke plant to be built by the H. Koppers Company in Canada. Some years ago it built 120 ovens for the Algoma Steel Company, Sault Ste. Marie.

Accidents at Metallurgical Plants

Fatal accidents reported at metallurgical plants in the United States in 1915 were 68, of which 30 were at ore-dressing plants and 38 at smelters. In 1914 these were 23 and 33 respectively. These data are from the second report of the Bureau of Mines on accidents at metallurgical works, and cover returns from 110 smelting plants in 1915 as compared with 94 in 1914, and include copper, lead, zinc and quicksilver smelters, as well as refineries, but do not include iron-blast furnaces. They represent also concentrating plants for copper, lead and zinc ores, stamp mills, cyanide plants and iron-ore washers. Non-fatal injuries at ore-dressing plants in 1915 were 2095 and at smelters 5718; these were 1434 and 5673 respectively in 1914. There were 63 permanent partial disabilities at ore-dressing plants and 87 at smelters. Total men employed were 49,891 in 1915, as compared with 41,461 in 1914.

German Steel Shipments Decreasing

Monthly shipments of the German Steel Works Union continue to decrease, those for October having been only 230,544 metric tons, as compared with 244,212 tons and 250,831 tons in September and August respectively. In October, 1915, the total was 257,278 tons. The average for the 10 months to Nov. 1, 1916, was 276,929 tons, as against 293,471 tons per month to July 1, 1916, and 270,510 tons per month for 1915. The October shipments were made up of 26,384 tons of semi-finished steel, 81,447 tons of railroad material and 72,723 of shapes.

Coke will be produced at the new plant of the Seaboard By-product Coke Company at Jersey City, N. J., early next year, estimating from the present stage of the construction work. By first erecting only temporary steel sheds to cover the 110 ovens while under construction, the H. Koppers Company, Pittsburgh, which started work May 1 this year, has been able to bring the ovens rapidly toward completion. The by-product building, boiler house, quenching track, purifiers and coal and coke-handling apparatus have been started in the order named. The benzol plant will be the last structure undertaken.

The Henry Miller Foundry Company, Cleveland, has been incorporated with a capital stock of \$1,000,000. This new company has been formed to merge the T. E. Henry Furnace Company and the foundries controlled by the same interest in Medina, Canton and Chagrin Falls, Ohio. T. E. Henry is president; C. H. Miller, vice-president, and E. S. Moncrief, secretary and treasurer.

British Supervision of Steel Tightens

U. S. Vice-Consul Richard Westacott, London, England, sends the following, under date of Nov. 28, which appears in *Commerce Reports* of Dec. 18:

An order has been issued by the Ministry of Munitions of War concerning steel bought and sold or manufactured in this country, and also steel imported from any other country. A clause of the order shows that the regulation affects all imported steel made by the open-hearth or Bessemer process, in so far as its distribution on arrival in the United Kingdom is concerned. The chief provisions of the order are:

No order for steel made by the open-hearth or Bessemer process (other than shell-discard quality) shall be accepted for manufacture, and no such steel shall be manufactured unless the purpose for which the steel is required has been approved.

Full and accurate returns shall be made weekly to the Director of Steel Production, Ministry of Munitions, Whitehall Place, London, S.W. In the form provided by him, showing particulars of all steel manufactured and delivered.

No special form of certificate to accompany an order is required, but the following particulars must accompany all orders: Government contract reference and number, with purpose, or Ministry of Munitions permit reference and number, with priority classification and purpose and a declaration that the whole of the material specified is required for the purpose covered by the references and classification.

For the purpose of this order the term "manufacture" shall include casting, rolling, or rerolling, forging, and pressing, and the term "steel" shall include all forms of open-hearth or Bessemer steel made in this country or imported, whether new, second hand, defective, or scrap for rerolling.

Bethlehem Ingot Mold Foundry

The rapid expansion of steel production facilities at South Bethlehem, Pa., and the acquisition of subsidiary plants have created a necessity for greater ingot-mold-producing capacity. The Bethlehem Steel Company, therefore, has planned an ingot-mold foundry with a nominal capacity of 590 tons per day, or 150,000 tons per annum, to be located at the eastern end of its Saucon plant. The building will be 550 x 250 ft., of brick and steel construction, and will be equipped with all the latest facilities for economical production of ingot molds, flasks and stools. It is planned to use direct metal, and for this purpose a 400-ton mixer will be installed as well as two 7-ft. cupolas to melt from cold stock when desired.

The building and yard storage will be covered with high-power traveling cranes to economize handling of materials. A pneumatic sand-handling apparatus will deliver the various sands from their respective mixers to points required in forming molds. The foundry is to be well equipped with core ovens, cranes, cupolas, sand-handling machinery, compressors, and toilet and wash rooms. The cost of the building and equipment will approximate \$750,000. About 250 skilled employees will be required for operation to full capacity.

Wellston Furnace Reconstruction

The Wellston Iron Furnace Company, Wellston, Ohio, has completed the reconstruction of its No. 1 stack, which will be operated in conjunction with the No. 2. These furnaces are controlled by M. L. & S. Sternberger, Jackson, Ohio, as noted in THE IRON AGE of June 10, 1916. At the time the plant was taken over, the stoves and power equipment were in good condition, but No. 2 stack required relining and No. 1 stack complete rebuilding. This work has been accomplished, No. 2 having been in operation since early in August and No. 1 being ready for operation as soon as a supply of coke can be relied upon. The Frazier-Sheal Company, Cleveland, did the engineering for this work; the Morrow Mfg. Company, Wellston, the steel work, and John Rinehart, Cleveland, the brickwork.

Following a campaign which resulted in nearly trebling the membership of the Merchants & Manufacturers' Association of Baltimore, Md., that body plans to establish a foreign trade bureau, a retail credit bureau and a national and international advertising campaign in the interests of Baltimore and merchants of that city.

Important Measure for Large Shippers

WASHINGTON, D. C., Dec. 19, 1916.—A measure of much importance to large shippers who, in the ordinary course of business, load on railroad cars a considerable proportion of their own freight, has been introduced in the Senate by Senator Pomerene, of Ohio, as an amendment to the bill of lading act passed by Congress at the last session. The new bill is designed to remedy a serious defect in the law due to the haste with which it was necessary to force its consideration in order to secure its passage on the eve of the adjournment of the session.

Few, if any, measures of interest to the business community passed by the present Congress are more important than the negotiable bill of lading act which became a law last August. This legislation, estimated to affect annually consignments of merchandise valued at the enormous sum of twenty-five billion dollars, was first brought to the attention of Congress early in 1912 by the Commission on Uniform State Laws of the American Bar Association, the leading railroad systems and the largest shippers' associations of the country. The original measure was introduced by Senator Pomerene and in a slightly modified form as applied to interstate transactions has already become the law in 10 of the leading States of the Union. The chief purpose of the bill was to render bills of lading a sound basis for bank advances, by prohibiting, under severe penalties, the alteration, forging or counterfeiting of bills or any other irregular practice calculated to detract from the value of bills for banking and credit purposes. An important provision of the bill prohibited carriers from indorsing bills of lading "Shippers' weight, load and count," for the purpose of evading responsibility for loss in transit.

When the Pomerene bill, after passage by the Senate, was reported to the House by the Committee on Interstate and Foreign Commerce a provision was inserted relieving carriers from responsibility for goods actually loaded by the shippers. The bill as thus amended was passed by the House and sent to conference. Believing that one of the most important features of the bill was nullified by the House amendment, Senator Pomerene was strongly disposed to prevent the adoption of the conference report, which, in view of the parliamentary situation, he could easily have done, but he also realized the importance to shippers of the early passage of the other provisions of the bill and he, therefore, accepted the House amendment, but gave notice that upon the reconvening of Congress he would introduce a new bill intended to close the gap in the original measure. He has, therefore, presented in the Senate a substitute for section 21 of the bill of lading act, to read as follows:

That when goods are loaded by a shipper at a place where the carrier maintains an agency such carrier shall, on written request of such shipper and when given a reasonable opportunity by the shipper so to do, count the packages of goods, if package freight, and ascertain the kind and quantity, if bulk freight, within a reasonable time after such written request, and such carrier shall not, in such cases, insert in the bill of lading or in any notice, receipt, contract, rule, regulation, or tariff "shippers' weight, load and count," or other words of like purport, indicating that the goods were loaded by the shipper and the description of them made by him. If so inserted, contrary to the provisions of this section, said words shall be treated as null and void and as if not inserted therein.

The new measure will probably pass the Senate at an early date, having been approved by that body no less than three times in as many years, but it will have to run the gauntlet of the House Committee on Interstate and Foreign Commerce, which for some occult reason stubbornly opposed the original Pomerene bill and, in finally yielding to public opinion, emasculated one of the most important features of the measure.

W. L. C.

The Cutler-Hammer Mfg. Company, Milwaukee, has leased the main arena of the Milwaukee Auditorium for the first annual Christmas celebration for its employees on Dec. 22. Provision is being made for more than 5000.

Wage Advances and Bonuses

To avert a general tie-up, with ruinous results for the trade, the stovemakers of the country, through the wage committee of the Stove Founders' National Defense Association, agreed Dec. 16 to the largest single wage advance ever accorded workers in that industry. Under the agreement, first acceded to by a subcommittee and ratified later by the committee of the whole of the stove manufacturers and the International Molders' Union, men who work in stove plants are to receive wage advances aggregating a little more than 18½ per cent. On Jan. 1, when the new scale takes effect for one year, stove foundry workers also will have a working day shorter by 30 minutes than that stipulated in the agreement effective for the last four years. The conference was held at Atlantic City and had been in session since Dec. 6. The men asked for an advance of 25 per cent.

Striking molders and coremakers have returned to work at the plant of the Simms Foundry Company, Racine, Wis., after being out two weeks. This is the first relief from the general foundry strike declared by the unions Dec. 1. The Simms Company made no concessions and continues as an open shop.

The Blaw Steel Construction Company, Pittsburgh, whose works are located at Hoboken, Pa., has announced that bonuses will be given to all employees not participating in the existing profit-sharing arrangement, who have been in the service of the company six months or more. Employees of longer than three years' standing will receive 7 per cent of their 1916 salary; from two to three years, 6 per cent of this year's salary, and from six months to two years, 5 per cent.

The Ohio Seamless Tube Company, Shelby, Ohio, has granted its employees a voluntary advance in wages of 10 per cent, effective from Dec. 15.

Effective Dec. 16, the H. C. Frick Coke Company announced a general advance in wages of about 10 per cent, and later other leading coke producers, notably W. J. Rainey, Washington Coal & Coke Company and Hostetter-Connellsville Coke Company, announced a similar advance. Wages at the advanced rate are as follows:

Pick mining and loading room and rib coal, per 100 bu.	\$1.82
Pick mining and loading heading coal, per 100 bu.	2.02
Pick mining and loading wet heading coal, per 100 bu.	2.20
Drawing coke, per 100 bu. charged.....	1.05
(All the above by same measurement as at present)	
Drivers and rope riders (shafts and slopes), per full run	3.50
Drivers and rope riders (drifts), per full run... .	3.45
Cagers, per full run.....	3.50
Fire bosses, per day.....	4.20
Tracklayers, blasters and timbermen (shafts and slopes), per day.....	3.50
Tracklayers, blasters and timbermen (drifts), per day	3.45
Assistant tracklayers and assistant timbermen, per day	2.90
Inside laborers, per day.....	2.75
Dumpers and tipplemen, per full run.....	2.75
Leveling, per oven (hand).....	16 1/4
Chargers, per day	2.75
Forking cars, 40,000-lb. capacity and less.....	2.25
Forking cars, 50,000 and 60,000 lb. capacity.....	2.35
Forking cars, over 60,000 lb. capacity.....	2.50

The prices for all other labor regularly employed in the operation of the plants will be proportionate with the above. "Full run" men to be paid for extra time as heretofore.

It is said this advance in wages affects close to 100,000 coal miners and coke workers, and places the wage rate for these classes of labor at the highest point it has ever reached. It is the third advance in coal miners' and coke workers' wages made since Jan. 1, 1916, the first having been announced Feb. 1, and the second May 8. In spite of the very high wages now being paid, there is a serious shortage in labor in the Connellsville coal and coke fields, which is restricting the output.

The A. O. Smith Corporation, Milwaukee, has given each of its 1400 employees a life insurance policy under

the group plan, and in addition increased the wages of all in the service more than three months, and receiving less than \$125 per month, by 10 per cent.

The New Jersey Zinc Company has decided upon a profit-sharing distribution by which its employees will receive 14 per cent of their wages the past year, payable in quarterly installments in 1917. Under the plan no employee is to receive in excess of \$1,000.

The Willys-Overland Company, Toledo, Ohio, has announced a voluntary increase in wages to its employees. The advance is on a sliding scale, depending on the man's present earnings, and ranging from 7½ per cent for those earning 40c. per hour to 10 per cent for those earning 30c. per hour. Piece-work rates will be raised 5 per cent.

The Doehler Die-Casting Company, Court and Ninth streets, Brooklyn, N. Y., with factories in Brooklyn, Newark, N. J., and Toledo, Ohio, has offered all its employees the following inducements in the form of an extra participating dividend on their wages: Beginning Jan. 1, 1917, whenever the company declares the regular dividend on its stock it will also declare a wage dividend amounting to 10 per cent per annum to all employees based on all wages actually received, including piece work and overtime. This wage dividend is subject to certain conditions as to the employee's term of service. He must first be in the company's employ without interruption for a full year before he can participate. Also, beginning Jan. 1, 1917, all employees who have been working on the basis of 50 hr. per week will be put on a basis of 48 hr. at the same pay. The company employs 1200 men, and has a weekly payroll of approximately \$25,000.

Locomotive Orders Continue Large

Locomotive orders reported in the past week have been 243. The American Locomotive Company will furnish the Wheeling & Lake Erie with ten Mallets, the Tata Iron & Steel Company with five switching engines, and the Philadelphia, Bethlehem & New England with four switching engines. The Baldwin Locomotive Works will build fifty Mikado locomotives for the Great Northern, thirty Mallets and ten Pacifics for the Baltimore & Ohio and four switching engines for the Duluth, Missabe & Northern. The Canadian Government Railways have ordered ten Santa Fes from the Montreal Locomotive Works. The American Locomotive Company will also build 110 decapod locomotives for the Russian Government, each locomotive having 52-in. driving wheel centers and weighing 202,000 lb. It is understood that this brings the total now ordered by the Russian Government to 331 engines, divided as follows: American Locomotive Company 150, Baldwin Locomotive Works 140 and Canadian Locomotive Company 41. It is stated that a total of 350 will be placed at this time and probably more later. Recent inquiries amount to forty-six locomotives, the New York, New Haven & Hartford negotiating for forty Santa Fes. To Dec. 16 inclusive the total orders for the month are estimated at 357, of which 210 are for export.

W. E. Welborne of Welborne & Co., 44 Whitehall Street, New York, will probably be president of the new Louisville Steel & Iron Company, Louisville, Ky., which will take over the old plant of the Louisville Bolt & Iron Company. Mr. Welborne and D. E. Potter, San Antonio, Tex., have acquired a large part of the holdings of George Holzbog, Jeffersonville, Ind., in the property and propose to begin the manufacture of bar iron and steel about Jan. 1. E. S. Quirke, formerly with the Swedish Iron & Steel Corporation, Brooklyn, N. Y., will be superintendent. The company has a capital stock of \$400,000.

The United Alloy Steel Corporation, Canton, Ohio, plans the erection of a new combination 14 and 12-in. bar mill for rolling merchant bars. The company is understood to have not yet decided whether to build this plant in Canton or in Detroit, Mich., where a site is under consideration.

STEEL CORPORATION'S BONUSES

Annual Stock Offer Also—Employees' Increase for Year, \$33,000,000

Chairman Elbert H. Gary made the following statement this week relative to the annual subscription by employees to the stock of the corporation and the annual distribution of bonuses. In the same connection he gives an idea of the vast sum involved in the wage increases of the year and the special compensation to be distributed at its close:

The United States Steel Corporation will, in accordance with the plan in force during the last thirteen years, offer to employees the opportunity to subscribe, during the month of January, for 35,000 shares of stock at a price somewhat below the market; and also will distribute the usual special compensation. The total amount of the latter has not yet been definitely determined, but it will be calculated on the basis heretofore fixed. A part will be paid in cash and the balance in preferred stock in the same proportions and on the same terms as last year. It is hoped distributions will be made to the smaller salaried men about Christmas and to the others about New Year's. Also many of the men in offices, particularly those not receiving special compensation above referred to, will receive increases in salaries to take effect Jan. 1.

As a rough estimate, it may be stated that the three wage increases, made Feb. 1, May 1 and Dec. 15 respectively, the increases in salaries from time to time, and the special compensation will aggregate for the year about \$33,000,000.

Imports of Ferromanganese

Ferromanganese imports into the United States in November, according to returns made to THE IRON AGE, were 7410 gross tons. In October they were 7914 tons; in September, 9237 tons, and in August, 8515 tons. The November imports bring the average for the 11 months of this year to 6390 tons per month. In 1915 it was only 4600 tons per month, while for the five years from 1910 to 1914 it was 8399 tons per month. The November imports were received as follows: 3264 tons through the port of Baltimore, 1371 tons through Philadelphia, 1238 tons through New York (818 tons of this from India), 927 tons through New Orleans and 610 tons through Newport News.

Spanish Steel Plants Extending

The war has caused the Spanish steel trade to burst into remarkable activity, according to a French trade paper. Exceptional profits made by a few steel companies fill other manufacturers with regret that they have not improved their plants. Recent events indicate a change: The Sociedad Altos Hornos de Vizcaya has increased its plant on a large scale; the Altos Hornos de Malaga has resumed after lying idle a long time; the Sociedad de Construcciones Mechanicos is increasing its capital to cope with orders for the French railroads, and another important company has very largely increased its capital.

Fire early in the morning of Dec. 18 damaged the electrical equipment of the universal mill of the Central Iron & Steel Company, Harrisburg, Pa., to the extent of about \$10,000. As the high power services for the 72 and 89-in. plate mills pass through the universal mill and were also somewhat damaged, this caused a temporary shut-down of these departments. It is expected to have everything in operation again within a few days.

Local committees in Italy have been formed to collect and forward scrap metals, for which prices will be fixed by the government. The appeal is made to the press, teachers, doctors and priests.

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THE EMPLOYER AND ACCIDENTS

His Duty Toward Their Prevention—What Has Been Done in a Large Steel Plant

One of the papers presented at the fourth annual welfare and efficiency conference of the State of Pennsylvania, held at Harrisburg, Nov. 21, 22 and 23, was by George T. Fonda, safety engineer, Bethlehem Steel Company. The subject was "The Employer's Duty Toward Accident Prevention." From this paper the following extract has been taken:

The employer's duty toward accident prevention is only one side of a most vital problem. In my mind the duty is no greater on the part of the employer than it is on the part of the employee, and the converse is just as true. The duty of the employer must be fully realized at the beginning, otherwise there can be no accident prevention in a given industry. Perhaps you will say that if this is true then the duty of the employer is certainly the most important, but I say to you the beginning of such a propaganda, while it is indeed important, would do little if the employee could not be made to see his duty in its fullest importance. The beginning would be a miserable failure and productive of little or nothing, if this had to be the full extent of our effort.

The prevention of accidents is only one small part of a great industrial problem—the conservation of the human machine. It is difficult to understand why the necessity for such conservation has not been more generally recognized by industry long before this, but it is most commendable to note the tremendous strides which have been taken in such a comparatively short time. Employers all over this great country are alive to the general situation, and they are in many cases doing much more than their duty.

Let us not forget that the workman is placed in industry to produce. This is his first function and if he fails at his task what will become of him? The average workman is ever mindful of the particular part he is taking and of the fact that his very existence is dependent upon his ability to do his work and do it right. Many times the faithfulness and conscientious endeavor of an employee is the direct cause of his being injured and here it is clearly the duty of the employer to promote safety to such an extent that the workman will know that it is part of his job to turn out the work without injury to himself or any one else. This is clearly the duty of the employer and cannot possibly be denied as being fundamental.

Workmen do not intentionally get hurt. Ignorance or carelessness describes the cause of not less than 90 per cent of our industrial accidents to-day and here again the employer cannot overlook his direct responsibility.

THE NEED FOR EDUCATION

Education, in any phase you care to look at it, is the first and foremost duty of every employer in the promotion of accident prevention. It has been said many times that the plant must be safeguarded before you can do much preaching, and I need not dwell upon this particular point, because no one would ever deny the psychology of this statement. As a matter of fact, there are very few employers who have not been spending thousands of dollars on safeguards and will continue to do so just as long as they can find unguarded machines inside of their plants. Strange to say, the education of workmen in its relation to accident prevention has not been taken up so generally. Many employers have recognized the full value of educational work of this kind, but have been at a loss as to how the situation can best be handled. This condition has existed more particularly in the smaller plants as a rule, these plants having found it difficult to organize the work. It seems to me that a co-operative movement on the part of the various interests in any given section would satisfactorily solve this problem and in view of the success which has been experienced among the larger industries throughout the United States, it

would appear that a movement of the kind mentioned would deserve careful consideration.

Education, the keynote to many economic problems, certainly stands out above everything else as an activity which must be recognized by the employer not only as a duty, but as an absolute necessity. The foreigner in our industries is the first individual to be reached. He knows nothing of the whirl and rush of American industry and with it all he is unable to speak or understand our language. A study of the accident statistics of the company which I have the honor to represent shows that from 60 to 70 per cent of all workmen losing two days or more as a result of injury are foreign born. A situation of this kind must be met, otherwise little progress can be expected and it is certainly the duty of the employer to see to it that proper consideration is being given to this most absorbing question.

There are a number of things much more easily accomplished than successfully teaching the English language to foreigners, but in the majority of cases you will find these men most eager for this knowledge, once you have made them understand what it is all about. In South Bethlehem, we are conducting a free evening school for foreigners and there are to date over 1000 workmen enrolled, including 28 different nationalities. These men are not forced to attend these classes, but are urged to do so for their own good and the Bethlehem Steel Company feels that any effort or money expended along these lines can only be productive of the best results.

The next step in any educational safety campaign is carefully organized shop committees appointed to serve for a definite period of time, after which part or all of these committees are replaced by new men. This is not a new suggestion to any one, but the handling of these committees has all to do with the success or failure of a most valuable part of the work under consideration. I have heard it stated that shop committees were not of particular value any longer because their usefulness could not last beyond a very limited period of time in any plant that was completely safeguarded, etc. Such a statement simply proves that the work has not been properly organized and a valuable opportunity is being lost.

WORK AT BETHLEHEM STEEL COMPANY

I trust you will pardon a reference here to the organization we have worked out in connection with the activities of my own company. We have organized departmental safety committees in each department and in a number of instances these committees are made up entirely of foreigners. They are started out under careful instruction and are taught to look for dangerous conditions in their respective departments which are reported as a result of departmental inspections made periodically by these committees. In addition to being taught to look out for dangerous conditions and eliminate them, these committees are thoroughly drilled in first-aid work, and as a team are required to enter the interdepartment meet held the latter part of each summer. The winners of the first three places in these meets are given prizes well worth the effort and a great deal of interest has been stimulated through our annual meets. This year, for example, the winning team was taken on a trip to Boston to one of the games of the World's Series and was fortunate enough to see the only 14-inning game ever played in a World's Series. You can well imagine that this particular departmental committee found out that "safety" was well worth while and it is this sort of stimulation that makes for success in the work and which, of course, is in direct proportion to the employer's appreciation of the services rendered by the departmental committees.

The constant changing of these committees must gradually change the atmosphere of the entire working force and the effect will be productive of good results. The work we have been doing at Bethlehem has been most successful, and in the face of great odds with a considerable number of "green men" being employed, we have had a decreasing accident rate even including the last 14 months.

Just another thought in the matter of education as affecting injury to workmen. We would indeed like to feel that accidents would no longer occur; however, we must admit that such is not the case, and more or less frequently there is an unfortunate accident. In many cases a rather slight injury almost causes a death or at the best causes much anxiety over a period of weeks and sometimes months. The injured is lacking in the necessary vitality to convalesce quickly, and here education again can help the general situation. A filthy home and an unhealthy body are indirectly the cause of numerous accidents and if the problem is to be attacked from all sides these facts cannot be overlooked. Where the employer has seen his duty in its fullest sense, it has been found that this duty toward accident prevention has led into many ways, but the outcome in every single instance has proven the value of the effort and few employers to-day are attempting to sidestep their known responsibilities.

Solid Oxides of Nickel and Copper Reduced by Iron

To determine whether solid oxide of nickel or solid oxide of copper would react on solid iron at temperatures far below their melting points several pieces of 1-in. round bars of Armco iron containing 0.02 per cent carbon were drilled down the center and filled respectively with nickel oxide and copper oxide and consolidated by forcibly driving in a plug of the same iron. The bars thus prepared were placed in a muffle furnace and heated to about 1000 deg. C. for about 6 hr. for 3 days. When drawn from the muffle they were sectioned by sawing vertically through the center and then examined.

Dr. J. E. Stead, who made the experiments and who presented the results to the Iron and Steel Institute at its autumn meeting in London, Sept. 22, 1916, offered the following conclusions:

1. It has been proved that solid iron is capable of reducing solid oxide of nickel and oxide of copper to the metallic state with the formation of iron oxide.
2. That the interchange is not confined to the surfaces of contact, but extends for a considerable distance from the surface of the iron, suggesting that there is interdiffusion of iron and nickel and iron and copper, and of the oxides of these metals.
3. That surface tension plays an important part in causing the reduced metals and the oxides to segregate into coherent independent masses.
4. There is some evidence that the reduced metals, copper and nickel, are alloyed with some iron. More research is being made to determine whether this is so.

New England Foundrymen Meet

The most largely attended meeting of the New England Foundrymen's Association this year took place at Young's Hotel, Boston, Dec. 13. The speaker of the evening was Dr. Richard Moldenke, whose subject was "Physics of Cast Iron." The address was marked by the introduction of many interesting figures on shrinkage and kindred subjects and by a recital of numerous recent experiments which have not yet found their way into print.

The Reliable Auto Heater Company, 735 Guardian Building, Cleveland, has secured a lease, with option to purchase the plant and equipment, in Ashtabula, Ohio, formerly occupied by the Ashtabula Mfg. Company and will establish a plant there for the manufacture of automobile heaters. S. T. Campbell, former general manager of the Cuyahoga Stamping & Machine Company, Cleveland, is interested in the new company.

It is stated that the Stamford Rolling Mills Company, Stamford, Conn., has taken a contract from the Ford Motor Company for \$2,000,000 worth of radiator brass, to be delivered within the year 1917. This company will have completed all its war contracts by Jan. 1.

LAKE ORE, 64,734,198 TONS

Adding All-Rail Shipments, Total May Exceed 66,000,000 Tons

The final reports from Lake Superior iron ore docks show that the total movement of lake ores by water in the season just closed was 64,734,198 gross tons. As already indicated in these columns the movement by water, together with the all-rail shipments (which are not known until the close of the year), will probably make a total for 1916 of more than 66,000,000 tons. The usual all-rail movement has been augmented in the past year by the ore shipped to the two Duluth furnaces of the Minnesota Steel Company, which went in blast a year ago, probably amounting to more than 500,000 tons. The movement of ore by vessel in December was extraordinary, amounting to 1,085,900 tons. In the table below are given the shipments by ports for 1916 and the three preceding years.

	Iron Ore Shipments from Upper Lake Ports—Gross Tons			
	1916	1915	1914	1913
Escanaba	7,457,444	5,649,289	3,664,454	5,399,444
Marquette	3,858,092	3,099,589	1,755,726	3,137,617
Ashland	8,057,814	5,146,772	3,363,419	4,338,230
Two Harbors	12,787,046	8,642,942	5,610,262	10,075,718
Superior	21,837,949	8,342,793	11,309,748	13,788,343
Duluth	10,735,553	15,437,419	6,318,291	12,331,126
Total by lake	64,734,198	46,318,804	32,021,900	49,070,478
Total all rail		953,947	707,826	876,638
Total shipments			47,272,751	32,729,726
				49,947,116

It will be seen that the shipments from Minnesota alone—over 45,300,000 tons—were nearly equal to the entire ore movement of 1915. The Marquette shipments show that the Marquette range is capable of only a limited response to such a demand as this year. The Menominee range did somewhat better, while the Gogebic increased nearly 60 per cent upon its production of 1915. The Mesaba and Cuyuna ranges contributed more than two-thirds of the entire movement.

Indiana Manufacturers Meet

At the annual meeting of the Indiana Manufacturers' Association at Indianapolis, Dec. 14, B. A. Van Winkle, Hartford City, was re-elected president. It will be his fourth term. H. M. Clemons, Cannelton, was elected vice-president; Henry C. Atkins, Indianapolis, second vice-president; F. M. Smith, Indianapolis, secretary; George O. Rockwood, Indianapolis, treasurer. Directors elected were: C. C. Hanch, South Bend; J. M. Herron, Connersville; Lee Rodman, Cannelton; B. F. Behren, Evansville; F. S. Hunting, Fort Wayne, and S. E. Swayne, Richmond.

The association adopted a resolution opposing eight-hour and minimum wages laws and resolved further to oppose honorably the introduction and passing of all such bills. In the discussion of the resolution it was said such altruistic measures would put Indiana manufacturers under a handicap in competing with those in foreign countries and eventually drive them out of business. It was further argued that labor neither wishes nor expects an eight-hour day. Alfred P. Thom, Washington, D. C., general counsel for the Railway Executives' Advisory Committee, was the chief speaker at the association's annual banquet. He made a plea for exclusive Federal control of railroad regulation.

Iron-Ore Deposits in Africa

Iron-ore deposits in the German colonies of West Africa are reported as large by a French authority. In Togoland the iron ore is hematite, containing 89.51 per cent. iron oxide, 9.47 per cent. infusorial earth, 0.24 per cent. alumina, 0.16 per cent. manganese oxide, and 0.30 per cent. phosphorus acid. The deposit probably represents 20,000,000 gross tons. In the Kamerun district an abundant deposit analyses 42.29 per cent. metallic iron; manganese, 0.35 per cent.; phosphorus, 0.17 per cent., and infusorial earth, 12.26 per cent.

Iron and Steel Markets

APPRAISING PEACE TALK

First Steel Trade Halt Short Lived

Fresh Foreign Buying of Shell Steel and Cars— Price Advances Not Over

The first effect of peace talk upon the steel trade was a halt in new orders. That was confined, however, to last week. The market of the past three days shows a practical return to conditions of ten days ago. Domestic consumers are working just as hard to get steel from the mills, inquiry keeps up for all forms of product and the new foreign demand is greater than can be considered.

Here and there is a change of attitude as to placing orders for the far future, and a resurvey of projects based on indefinite continuance of the war. What has happened mainly is that peace is taking a definite place in calculations, whereas it had no place before or was thought of as too far in the future to affect present plans.

The difficulties of getting any early deliveries of pig iron or steel or any concessions in prices for such deliveries are unchanged by the peace proposal. That the war may end in 1917 is more seriously thought of than heretofore, and it is granted that price readjustments will anticipate the end. Yet the immediate movement of some prices may even be upward. Billets are \$5 and light rails \$3 higher this week. Early advances in contract plates, shapes and bars are looked for, and wire products apparently have not yet reached their high point. It is an interesting fact that the buyers for the Allies have lately made a more determined set for lower prices on forging contracts for the second half of next year.

Some mills have not yet opened their books for the second quarter of 1917; more have made no sales for the second half, but there is now every indication that all the deliveries promised for the first half cannot be made in that period.

In view of the large contracts for shell steel already on the books for the Allies to be shipped in 1917, probably 3,000,000 to 3,500,000 tons, it is significant that France and Italy have placed additional orders in the past week—Italy for upwards of 25,000 tons. Italy only lately bought 25,000 tons of barb wire here, part of a total of 75,000 tons of wire products for export taken by the Steel Corporation in November.

Car builders have been large buyers of plates and shapes, estimates ranging above 100,000 tons. A 3000-car order for Russia was divided between two companies and all told 10,000 cars have been ordered in a week. Russia's recent locomotive contracts cover 350 and both Great Britain and France are buying locomotives here.

Transportation machinery is breaking down in all directions and the situation is most acute in the Pittsburgh and Valley districts. More blast furnaces have banked because short of coke, and steel is piling up at the mills. The deplorable shortsightedness of the railroads promises more or less of a blockade at Pittsburgh throughout the winter. There will be no ten-day shut down there, as has

been proposed; such a thing, with the present demand for steel, is out of the question. Pittsburgh district producers are hurt also by serious lack of natural gas.

Apart from car material, plate mills still have a large business offered them. Italy is making new efforts to get 10,000 tons of plates, and the demand from neutral countries is unabated.

Europe's need of railroad steel is seen in the taking up of 100,000 tons of rails in Canada for shipment to France. A similar removal of Canadian track was made some months ago. The replacement of such steel will be but one factor in the after-the-war demand.

Producers of wrought pipe are generally sold up for six months; with business from usual customers added, some have little to offer in the second half. Late gas and oil line business includes 100 miles of 8-in. pipe, and 500 miles of 8-in. pipe for Oklahoma and Texas oil lines will soon be placed. For a Canadian natural-gas line 80 miles of 10 to 16-in. pipe will be wanted.

Domestic pig-iron inquiry has fallen off sharply, and export business is less. Italy has just taken 10,000 tons more of Bessemer iron. Steel-making pig iron in the Pittsburgh district is very quiet.

Blast furnaces are facing much higher coke cost. They refused to contract at \$4 for the first half, but \$4.50 is now the producers' figure. Spot coke has sold in considerable quantity at \$9.

The general use of 50 per cent ferrosilicon in steel-works operations makes important the reported limitation of Canadian electric power now employed at Niagara in making this product for the American market. The movement is causing concern to other American users of Canadian power.

The scrap trade, with its well-known speculative features, was more affected by the peace proposal than any other department of the market. Demand fell off precipitately, and material has only been moved at the expense of prices.

Pittsburgh

PITTSBURGH, PA., Dec. 19, 1916.

A decided halt occurred in new steel business the latter part of last week because of the peace talk started by Germany. While there was no decline in prices, buyers were in the air as to what might happen and many negotiations for purchases of steel were either called off entirely or held up. Yesterday and to-day this feeling had largely disappeared, due to the announcement by Lloyd George before the British Parliament that no peace negotiations would be entered into with Germany until England and its allies knew what Germany has to offer. The belief now is that the war is bound to go on for a year at least. The transportation situation in this district is deplorable, steadily getting worse. There is a decided lack of cars and motive power to handle the freight being offered to the railroads, and the movement of passenger trains is also affected. The Wabash has placed an embargo on all kinds of freight except perishable goods and foodstuffs, and it is said the Pittsburgh & Lake Erie, one of the New York Central lines, operating between Pittsburgh and Youngstown, is on the point of declaring an embargo. Blast furnaces are suffering greatly

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

For Early Delivery

Pig Iron, Per Gross Ton:	Dec. 20.	Dec. 13.	Nov. 22.	Dec. 22.
	1916.	1916.	1916.	1915.
No. 2 X, Philadelphia...	\$29.50	\$29.50	\$25.50	\$19.50
No. 2, Valley furnace...	31.00	31.00	26.00	18.50
No. 2 Southern, Cin'ti...	25.90	25.90	23.90	17.40
No. 2, Birmingham, Ala...	23.00	23.00	21.00	14.50
No. 2, furnace, Chicago*	30.00	30.00	27.00	18.00
Basic, del'd, eastern Pa...	30.00	30.00	26.00	18.50
Basic, Valley furnace...	30.00	30.00	25.50	18.00
Bessemer, Pittsburgh...	35.95	35.95	30.95	19.95
Malleable Bess., Ch'go*	30.00	30.00	27.00	18.50
Gray forge, Pittsburgh...	29.95	29.95	26.95	18.10
L. S. charcoal, Chicago...	31.75	31.75	26.75	19.25

Rails, Billets, etc., Per Gross Ton:

Bess. rails, heavy, at mill	38.00	38.00	38.00	28.00
O.-h. rails, heavy, at mill	40.00	40.00	40.00	30.00
Bess. billets, Pittsburgh...	60.00	55.00	52.50	32.00
O.-h. billets, Pittsburgh...	60.00	55.00	52.50	33.00
O.-h. sheet bars, P'gh...	60.00	55.00	52.50	35.00
Forging billets, base, P'gh	80.00	80.00	78.00	52.00
O.-h. billets, Phila...	60.00	60.00	55.00	40.00
Wire rods, Pittsburgh...	70.00	70.00	65.00	40.00

Finished Iron and Steel,

Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Iron bars, Philadelphia...	3.159	3.159	2.659	2.059
Iron bars, Pittsburgh...	3.25	3.25	2.90	1.80
Iron bars, Chicago...	3.00	2.75	2.65	1.75
Steel bars, Pittsburgh...	3.00	3.00	2.90	2.00
Steel bars, New York...	3.169	3.169	3.069	2.169
Tank plates, Pittsburgh...	4.25	4.25	4.25	2.25
Tank plates, New York...	4.419	4.419	4.419	2.419
Beams, etc., Pittsburgh...	3.25	3.25	3.00	1.90
Beams, etc., New York...	3.419	3.419	3.019	2.069
Skelp, grooved steel, P'gh	2.85	2.85	2.85	1.70
Skelp, sheared steel, P'gh	3.00	3.00	3.00	1.80
Steel hoops, Pittsburgh...	3.25	3.25	3.25	2.00

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

for lack of coke, and several have had to bank, while others will do so in a few days unless the situation quickly gets better. Reports of a concerted movement by manufacturers in the Pittsburgh and Valley districts to close down for a week to allow the railroads to relieve the freight congestion are incorrect. Anything that may be done in this direction by furnace men, steel makers and other manufacturers will be done individually. Some furnaces are running only from day to day, not knowing whether the coke supply for the next day will be received or not. Billets are being quoted at \$60 to \$65 per ton and are reported sold up to \$65. Prices on sheets among independent mills are up probably \$5 per ton. The feeling is growing that perhaps top prices have about been reached on pig iron and semi-finished steel, if not on most lines of finished steel. Consumers find they cannot place contracts except for delivery very far ahead and at abnormally high prices, and they are getting to think that it would probably be better to hold off and take chances on getting on the books of the mills at about the time they will need the material.

Ferroalloys.—Some negotiations for quite large lots of domestic ferromanganese that were on before the statement from Germany came out are stopped, but may shortly be taken up actively again. Domestic 80 per cent ferromanganese is held at \$165 to \$170 at furnace and English 80 per cent at about \$160, seaboard. No sales of note were made in the past week. We quote 18 to 22 per cent spiegeleisen at \$50 to \$55 and 25 to 30 per cent at \$65 to \$75, delivered. We quote 50 per cent ferrosilicon for delivery next year, in lots up to 100 tons, at \$100; 100 tons to 600 tons, \$99, and over 600 tons, \$98, all per gross ton, f.o.b. Pittsburgh. We now quote 9 per cent ferrosilicon at \$39 to \$41; 10 per cent, \$40 to \$42; 11 per cent, \$41 to \$43; 12 per cent, \$42 to \$44; 13 per cent, \$43.50 to \$45.50; 14 per cent, \$45.50 to \$47.50; 15 per cent, \$47.50 to \$49.50, and 16 per cent, \$50 to \$52. We quote 7 per cent silvery at \$29.50 to \$30; 8 per cent, \$30 to \$31; 9 per cent, \$30.50; 10 per cent, \$31; 11 per cent, \$32, and 12 per cent, \$33. These prices are f.o.b. at furnace,

Sheets, Nails and Wire, Per Lb. to Large Buyers:

	Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Sheets, black, No. 28, P'gh	4.50	4.25	3.65	2.50	
Sheets, galv., No. 28, P'gh	6.25	6.00	5.25	4.75	
Wire nails, Pittsburgh...	3.00	3.00	2.85	2.10	
Cut nails, Pittsburgh...	2.95	2.95	2.80	1.90	
Fence wire, base, P'gh...	2.95	2.95	2.80	1.95	
Barb wire, galv., P'gh...	3.85	3.85	3.70	2.95	

Old Material, Per Gross Ton:

	Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Iron rails, Chicago...	\$29.00	\$29.00	\$25.00	\$16.00	
Iron rails, Philadelphia...	27.00	27.00	24.00	19.50	
Carwheels, Chicago...	21.50	22.00	18.00	14.50	
Carwheels, Philadelphia...	22.50	22.50	19.00	16.00	
Heavy steel scrap, P'gh...	27.00	27.00	21.00	17.50	
Heavy steel scrap, Phila...	24.00	24.00	21.00	16.00	
Heavy steel scrap, Ch'go...	23.50	23.50	21.00	15.75	
No. 1 cast, Pittsburgh...	23.00	23.00	17.00	15.25	
No. 1 cast, Philadelphia...	21.00	21.00	19.00	16.75	
No. 1 cast, Ch'go (net ton)	16.50	16.50	16.00	13.75	
No. 1 RR. wrot, Phila...	27.00	27.00	24.50	21.00	
No. 1 RR. wrot, Ch'go (net)	25.00	26.00	22.00	15.25	

Coke, Connellsville, Per Net Ton at Oven:

	Furnace coke, prompt...	\$9.00	\$7.50	\$6.50	\$3.25
Furnace coke, future...	4.00	4.00	3.75	2.40	
Foundry coke, prompt...	9.00	8.00	7.00	3.25	
Foundry coke, future...	6.00	6.00	5.00	3.00	

Metals,

	Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York...	\$2.50	35.50	34.00	20.25	
Electrolytic copper, N. Y...	\$2.50	35.50	34.00	20.25	
Spelter, St. Louis...	10.00	11.50	12.25	17.25	
Spelter, New York...	10.25	11.75	12.50	17.50	
Lead, St. Louis...	7.40	7.80	7.00	5.30	
Lead, New York...	7.50	7.90	7.15	5.40	
Tin, New York...	12.37 1/2	43.00	45.12 1/2	39.50	
Antimony (Asiatic), N. Y...	14.25	14.00	14.00	39.00	
Tin plate, 100-lb. box, P'gh...	87.00	\$6.50	\$6.00	\$3.50	

Jackson or New Straitsville, Ohio, and Ashland, Ky., all of which have a freight rate of \$2 per gross ton to the Pittsburgh district.

Billets and Sheet Bars.—We are advised of several sales of sheet bars on the basis of close to \$65, Pittsburgh. One sale is said to have been 1000 tons, while another is given at 15,000 tons. The latter sale was by a nearby plant, and the price was \$65, maker's mill. It is doubtful whether any billets or sheet bars could be picked up from any source at less than \$65, and they might be hard to find even at this price. It is said one sheet mill in the Youngstown district that is ready to operate remains idle because sheet bars cannot be secured. There is still some export inquiry for billets and sheet bars of ordinary carbons, and also for high-carbon billets, but none of these inquiries is being figured on by local mills, as they do not have the steel to spare. We now base sizes and base carbons of Bessemer and open-hearth billets and sheet bars at \$60 to \$65, maker's mill, Pittsburgh or Youngstown, and forging billets \$80 to \$85, for sizes up to but not including 10 x 10 in. and for carbons up to 0.25.

Pig Iron.—The local pig-iron market has been very quiet. Sales were fewer in number and less in quantity than in any week for some months. As prices are higher than they have been in many years, buyers are inclined to hesitate before making contracts for iron that they will not be able to get for some months. One sale of 1000 tons of Bessemer was made here last week for export at \$35, Valley furnace, and there was a sale of 500 tons a month of basic iron for January-March at a price equal to \$30 or less, Valley furnace, the iron having been sold by a furnace located near where it is to be used and having a nominal freight. We quote standard Bessemer iron, \$35; basic, \$30 to \$31; gray forge, \$29; malleable Bessemer, \$30, and No. 2 foundry, \$31 to \$32, all at Valley furnace, the freight rate for delivery in the Pittsburgh or Cleveland district being 95c. per ton.

Plates.—New inquiry for steel cars is active, but few orders are being placed. The Clark Car Company has ordered 500 dump cars from the Cambria Steel Com-

pany, and the New York Central Lines have placed 1200 50-ton steel hopper cars with the American Car & Foundry Company, while the Norfolk & Western will build at its Roanoke shops 1000 60-ton steel hopper cars and has placed orders for the plates and shapes, about 6000 tons, mostly with Pittsburgh mills. The Wheeling & Lake Erie is in the market for 500 gondolas and 500 steel hoppers, while the Northern Pacific is inquiring for 1000 box cars and 500 automobile cars, the Minneapolis and St. Louis for 500 steel gondolas, the Illinois Central for the same number, and the St. Louis, Brownsville & Mexico for 500 stock cars. The nominal prices of $\frac{1}{4}$ -in. and heavier sheared plates is still 3.50c., but only the Carnegie Steel Company is naming this price, and it is sold up on plates for all of 1917. Other mills are quoting 4c. to 4.50c. for second and third quarter delivery, and several sales of good-sized lots have been made at 5c. at mill for second quarter. On small lots for fairly prompt shipment, prices quoted range from 5c. to 6c. at mill, f.o.b. Pittsburgh.

Structural Material.—New inquiry is active and some large contracts have been placed. The McClintic-Marshall Company has taken about 2500 tons from the H. Koppers Company, to be used in steel work for the Maryland Steel Company and the Colorado Fuel & Iron Company, also 2500 tons for extensions to the plant of the John A. Roebling Sons Company. The American Bridge Company has taken 500 tons for transmission towers for the American Gas & Electric Company, Wheeling and Windsor, W. Va. The Pittsburgh Bridge & Iron Works has taken 500 tons for an extension to a power house at Lowellville, Ohio, and the Blaw Steel Construction Company, 750 tons for a new erecting shop for the Standard Shipbuilding Company, Staten Island. The Massillon Bridge & Iron Company has taken 500 tons for plant extension for the National Pressed Steel Company. We quote beams and channels up to 15 in. at 3c. at mill, with no promise of delivery, and from 3c. to 3.25c. for second and third quarter shipment in 1917; small lots from warehouse stock, 3.50c. to 3.75c., Pittsburgh.

Steel Rails.—Effective Monday, Dec. 18, the Carnegie Steel Company advanced prices on light rails as follows: 25 to 45 lb. sections, \$50.16, and 20 lb., \$48; 12 and 14 lb., \$52; 8 and 10 lb., \$53, in carload lots, f.o.b. mill, with usual extras for less than carloads. As yet nothing has been heard here of the contemplated order of the Pennsylvania Railroad for 205,000 tons. We quote standard section rails of Bessemer stock at \$38 and of open-hearth, \$40 per gross ton, Pittsburgh.

Cold-Rolled Strip Steel.—New buying is light and confined mostly to small lots for fairly prompt shipment, consumers having covered their needs for first quarter. Makers have not opened their books for sales for delivery in second half, but are being importuned to do so by consumers. On current orders for fairly prompt shipment, makers quote \$7 for fair-sized quantities up to \$7.50 per 100 lb. for small lots. Terms are 30 days net, less 2 per cent off for cash in 10 days, delivered in quantities of 300 lb. or more when specified for at one time.

Hoops and Bands.—The new demand is light, as nearly all consumers are covered over the first quarter or first half, and mills report specifications active. The nominal price of the Carnegie Company on hoops is 3.25c. and on steel bands, 2.90c., but it is reported sold up for practically all of next year. Other makers are quoting 3.25c. and higher on steel bands, with extras as per the steel-bar card, and steel hoops at 3.50c. or higher at mill.

Wrought Pipe.—An inquiry has been in the market for some little time for 80 miles or more of 10, 12, 14 and 16 in. line pipe for shipment to Canada for a natural gas line, but none of the mills can make the deliveries wanted, and it is doubtful whether the order will be placed. The Sinclair Oil & Refining Company is in the market for 500 miles of 8 in. to be used in paralleling its present oil lines from the Oklahoma and Texas fields to the Gulf. This is the largest and most active pipe inquiry in the market. Booth & Flinn,

Ltd., this city, has taken the contract for laying 100 miles of 8 in. for the Pierce Fordyce Oil Association, operating in Oklahoma and Texas, and the pipe has been placed with two or three mills. Several of the large makers say they are sold up to July 1, and, with orders from their regular trade that will come voluntarily, they are practically sold up for all of next year. If the mills could only make the deliveries wanted there would be some very large contracts placed for line pipe for gas and oil lines as the new inquiry is very heavy. Discounts on black and galvanized iron and steel pipe are given on another page.

Boiler Tubes.—Makers of both iron and steel tubes are sold up for the first half or longer, and on seamless tubes for practically all of next year. Premiums over regular prices are readily paid for either iron or steel tubes for fairly prompt delivery. An advance in prices is looked for at any time. Discounts in effect at this writing are given on another page.

Sheets.—A very wide range in prices is being quoted. On galvanized, this range amounts to from \$10 to \$12 per ton, and on Bessemer black and blue annealed from \$5 to \$10 per ton. The American Sheet & Tin Plate Company has no sheets for the first quarter, and other makers that can deliver in January can get almost any price they ask. This condition also applies largely on first quarter delivery. As an instance, a sale of a good quantity of No. 28 Bessemer black sheets was made a few days ago at 5.50c., f.o.b. Pittsburgh. Galvanized has sold at 7c. and higher for No. 28 for fairly prompt delivery. Consumers are having trouble in finding mills that have any sheets to spare for delivery before April. The tendency of prices is decidedly toward higher values. We quote blue annealed sheets, Nos. 3 to 8, at 4c. to 4.25c.; box annealed, one pass, Bessemer cold-rolled sheets, No. 28, 4.50c. to 5c.; No. 28 galvanized, 6.25c. to 7c.; No. 28 tin-mill black plate, 4.25c. to 4.50c., all f.o.b. mill, Pittsburgh. These prices are for carloads or larger lots, and the higher prices quoted are for reasonably prompt shipment.

Tin Plate.—A consumer who recently wanted to buy some more tin plate for first half delivery placed part of the order with one mill at about \$7 per box at mill and is said to have paid for the remainder about \$8. Positively no tin plate could be bought on current orders at less than \$7, and the more general prices quoted range from \$7.50 to \$8 at mill. A genuine famine prevails which promises to grow worse. Consumers are specifying freely against contracts. While the mills are making a record output, they will carry over at least two months' production into 1917. We now quote the market for delivery in the first half of next year at \$7 to \$8 per base box, f.o.b. mill. We quote I. C. terne plate, 107 lb., at \$7.15 to \$7.65, and 200 lb. carrying 8-lb. coating, at \$11, the usual advances applying for heavier weights and coatings.

Shafting.—Several makers of shafting that have not been trying to sell in the open market, but to take care of their regular customers, are now in position to ship to their trade in five to six weeks from date of order. Other makers that are sold ahead for some time cannot ship on new orders inside of two to three months. Most consumers are covered for first quarter on their needs at 15 to 20 per cent off list, and a few over first half. Prices are firm, and it is claimed the 20 per cent discount off list will soon disappear. It is said the output of shafting this year will be fully 25 per cent heavier than in any previous year. We quote cold-rolled shafting at 20 to 15 per cent off in carload lots and 10 per cent off in less than carload lots for first quarter and first half of 1917, f.o.b. Pittsburgh, freight added to point of delivery.

Railroad Spikes and Track Bolts.—Railroads that have contracts for spikes that expire this year are specifying freely, as any part of these contracts that is not specified for will be canceled Dec. 31. These were taken months ago when prices were much below what they are now. Most of the large roads are covered on spikes for the first half, and there is some inquiry for the second half, but local makers are not quoting for

delivery so far ahead. The demand for track bolts is reported quite heavy. We quote track bolts with square nuts at 4.85c. to 5c., to railroads, and 5c. to 5.25c. in small lots to jobbers, base. In the Chicago district lower prices than these are being named. Track bolts with hexagon nuts take the usual advance of 15c. per 100 lb. We quote railroad spikes as follows: 9/16 in. and larger, \$3.40, base; 7/16 and 1/2 in., \$3.50, base; 5/16 and 3/8 in., \$3.75, base; boat spikes \$3.65, base, all per 100 lb., f.o.b. Pittsburgh.

Wire Products.—One local mill is quoting \$3.25 on wire nails, when it does quote, to customers to whom it is not obligated, and has made sales at \$3.15, base, per keg. There has been no announcement of another advance in wire products, but this is looked for. The demand for wire nails and wire is still heavy, and several makers say they are turning down as much business as they are taking, if not more. All are sold up for two to three months, and some for a longer period. The car situation is bad, and this is holding back shipments. Prices are as follows. Wire nails, \$3, base, per keg; galvanized, 1 in. and longer, including large head barbed roofing nails, taking an advance over this price of \$2, and shorter than 1 in., \$2.50. Bright basic wire is \$3.05 per 100 lb.; annealed fence wire, Nos. 6 to 9, \$2.95; galvanized wire, \$3.65; galvanized barb wire and fence staples, \$3.85; painted barb wire, \$3.15; polished fence staples, \$3.15; cement-coated nails, \$2.90, base, these prices being subject to the usual advances for the smaller trade, all f.o.b. Pittsburgh, freight added to the point of delivery, terms 60 days net, less 2 per cent off for cash in 10 days. Discounts on woven wire fencing are 53 per cent off list for carload lots, 52 per cent for 1000-rod lots, and 51 per cent for small lots, f.o.b. Pittsburgh.

Wire Rods.—Prices are higher, and the new demand is urgent. We are advised of sales of 1500 tons or more of soft carbon Bessemer and open-hearth rods at close to \$75 at mill. It is said that rods for export to Canada have sold at about \$80 at mill for base carbons. The demand is heavier than the makers can fill. We quote soft Bessemer, open-hearth and chain rods at \$70 to \$75 per gross ton, f.o.b. Pittsburgh, but it would be difficult to find any mills that would sell at less than \$75.

Iron and Steel Bars.—There are no signs of any falling off in the demand for iron or steel bars, which is much beyond the capacity of the mills. Consumers are suffering severely in deliveries of bars by the mills, which are unable to get cars. When they do load several cars, these often stand in the shipping yard for hours before motive power is found to move them. The nominal price of steel bars remains at 2.90c. at mill, with no definite promise of delivery, but mills that can ship in the first quarter and first half are quoting 3c. to 3.25c. at mill. The demand for refined iron bars is heavy and prices are firm. The high cost of materials and labor has not apparently restricted the demand for reinforcing steel bars, which is very heavy; prices are firm and likely to be higher. We quote refined iron bars at 3.25c. and railroad test bars at 3.40c. in carload lots, f.o.b. Pittsburgh.

Rivets.—The new demand is reported fairly heavy, but most consumers are covered for the first quarter and some for the first half. There is a heavy export demand, but local makers are not quoting freely on these inquiries, as they need their entire output for their domestic trade. Makers' prices are as follows:

Buttonhead structural rivets, 1/2 in. in diameter and larger, \$4.25 per 100 lb., base, and conehead boiler rivets, same sizes, \$4.35 per 100 lb., base, f.o.b. Pittsburgh. Terms are 30 days net or one-half of 1 per cent for cash in 10 days.

Coke.—Due to the abominable situation in cars and motive power, furnaces are unable to get coke promptly and are buying wherever they can pick it up. One sale of 25 cars was made to-day (Tuesday) at \$9 and another of 15 cars at \$9.50 per net ton at oven. The Carnegie Company has banked one Clairton furnace and the Shennango Furnace Company one of its stacks for lack of coke. Others will have to be banked soon unless coke is

received more freely. The high prices obtainable for spot coke have a natural tendency to induce producers to ask high prices for contract coke, and some are quoting \$5 per ton at oven, and seem indifferent about selling at this price. Reports that two contracts for furnace coke had been closed at \$5 per ton for first half are denied. We now quote best grades of furnace coke for prompt shipment at \$9 to \$9.50, and on contracts from \$4 to \$5 per net ton at oven, but it is doubtful whether any producers would sell at less than \$4.50. Best grades of 72-hr. foundry coke for spot shipment are held at \$9 to \$10, and several makers are refusing to book any contracts at less than \$6 per net ton at oven. The Connellsville *Courier* gives the output of coke in the upper and lower Connellsville regions for the week ended Dec. 9 at 424,765 net tons, an increase over the previous week of 5388 tons.

Nuts and Bolts.—The expected advance has not yet been made by the makers. They say their costs are steadily going up, and the output is curtailed by the shortage in labor, while shipments are bad, as cars are scarce. The new demand is active, and all the makers are back in deliveries eight to ten weeks or longer. Discounts are as follows, delivered in lots of 300 lb. or more where the actual freight rate does not exceed 20c. per 100 lb., with terms 30 days net or 1 per cent for cash in 10 days:

Carriage bolts, small, rolled thread, 50 per cent; small, cut thread, 40 and 7 1/2 per cent; large 35 per cent.

Machine bolts, h. p. nuts, small, rolled thread, 50 and 5 per cent; small, cut thread, 40, 10 and 5 per cent; large, 40 per cent.

Machine bolts, c. p. c. and t. nuts, small, 40 and 5 per cent; large, 30 and 5 per cent. Bolt ends, h. p. nuts 40 per cent; with c. p. nuts, 30 and 5 per cent. Lag screws (cone or gimlet point), 50 per cent.

Nuts, h. p. sq. and hex., blank, \$2.60 off list, and tapped, \$2.40 off; nuts, c. p. c. and t. sq., blank, \$2.20 off, and tapped, \$2 off; hex., blank, \$2.50 off, and tapped, \$2.25 off. Semi-finished hex. nuts, 60 per cent. Finished and case-hardened nuts, 60 per cent.

Rivets, 7/16 in. in diameter and smaller, 45 and 10 per cent.

Old Material.—Due to the willingness of Germany to enter into peace negotiations, or for some other cause, likely the high prices ruling, the local scrap market has been quiet the past week. While prices are fairly firm, they are no higher. Local consumers seem to be pretty well covered, and are not actively seeking scrap. The market in the Youngstown district is more active than it is here, and we can note that one leading Youngstown consumer bought last week 20,000 to 25,000 tons of heavy steel scrap at around \$27, delivered. In the local market low phosphorus melting stock is scarce, and dealers have offered as high as \$37 for it. Borings and turnings are also quite active and firm. Prices being named by dealers at this writing for delivery in Pittsburgh and other consuming points that take Pittsburgh freight rates, per gross ton, are as follows:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh, delivered	\$27.00 to \$28.00
No. 1 foundry cast.....	23.00 to 24.00
Berolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	30.00 to 31.00
Hydraulic compressed sheet scrap.....	22.00 to 23.00
Bundled sheet scrap, sides and ends, f.o.b. consumers' mills, Pittsburgh district	17.50 to 18.50
Bundled sheet stamping scrap.....	16.00 to 16.50
No. 1 railroad malleable stock.....	21.00 to 22.00
Railroad grate bars.....	13.00 to 14.00
Low phosphorus melting stock.....	36.00 to 37.00
Iron car axles.....	48.00 to 50.00
Steel car axles.....	48.00 to 50.00
Locomotive axles, steel.....	50.00 to 51.00
No. 1 busheling scrap.....	19.00 to 20.00
Machine shop turnings.....	13.00 to 14.00
Old carwheels	23.00 to 24.00
Cast-iron borings	14.00 to 14.50
*Sheet bar crop ends	29.00 to 30.00
No. 1 railroad wrought scrap.....	22.00 to 24.00
Heavy steel axle turnings.....	17.00 to 18.00
Heavy breakable cast scrap.....	19.00 to 20.00

*Shipping point.

Philadelphia

PHILADELPHIA, PA., Dec. 19, 1916.

Bringing home, as it did, the fact that the European war has got to end, and that its termination may be nearer than had been suspected, Germany's peace proposal had a sobering effect on the minds of those who contract for future supplies of materials, and they include pretty much everybody. The pig-iron market has been quieter, but prices are as firm as ever. No change downward is noted in the quotations for any of the commodities, with the exception of old material. The dealers in scrap, in the absence of business, quote nominal prices, but they themselves are not offering as much as they did a week or two ago. So far as the pig-iron producers are concerned, their anxiety is chiefly in getting a sufficient supply of coke with which to keep their furnaces in operation. Some have paid \$8, oven, for prompt coke. The plate situation is unchanged, except that prices are more nearly uniform. Most of the makers of structural shapes quote 3.659c., Philadelphia. Steel bars are quoted at 3.159c., Philadelphia, but the market is nearer 3.409c. Discarded shell steel is in active demand at \$40 to \$50 per ton. The domestic makers of ferromanganese have raised their price to \$175, delivered, an advance of \$10.

Iron Ore.—No arrivals of iron ore were reported in the week ended Dec. 16.

Ferroalloys.—Domestic makers of 80 per cent ferromanganese have advanced their quotation to \$175, delivered, an advance of \$10, for any position up to July 1. Foreign material is unchanged at \$164, seaboard, but very little is to be had this side of March. Fifty percent ferrosilicon is unchanged at \$100, Pittsburgh, for carloads and \$99 for 100 tons or more, but these quotations are nominal, particularly so far as prompt is concerned. A leading producer is said to be confronted with a curtailment of its power which would affect its output seriously. Spiegeleisen is held at about \$55, furnace. Blast-furnace ferrosilicon is quoted by local dealers at \$48.44, delivered.

Pig Iron.—Speculative holders of pig iron, also consumers who have bought heavily of future deliveries on the assumption that present prices and demand will be supported by an indefinite continuance of the war, were made uneasy by the news of Germany's peace suggestion. The announcement put a further check on a market that already was tending toward quiet, but it cannot be said that prices have softened to any appreciable degree. Furnace operators are more concerned over the problem of securing sufficient and dependable deliveries of coke than they are over the peace talk. Some of them are struggling to get a sufficient supply to carry them over the holidays, and have paid \$8 per ton at oven for comparatively poor coke. For eastern Pennsylvania No. 2 X \$30, furnace, is the base usually quoted by producers, although an occasional lot may be had at a few cents under this figure; therefore, \$29.50 to \$30.50 is given as a fairly inclusive range, although quotations run higher. One maker quoting \$30, furnace, and under \$31, delivered, is not anxious to sell because of coke uncertainties and his heavy commitments. Virginia No. 2 X is quoted at \$28 to \$29, furnace, or \$30.75 to \$31.75, Philadelphia, depending on quantity and delivery, with the probability that \$27.50, furnace, might be done. For 500 tons of 5 per cent silicon Virginia iron \$30, furnace, or \$32.75, Philadelphia, was paid; and for two lots of 3 to 4 per cent silicon, each of 500 tons, \$29.25, furnace, or \$32, Philadelphia, was paid. A local locomotive works is reported to have taken 5000 tons of Virginia, but all that can be definitely located is 400 tons. Virginia furnaces have been having a troublous time in shipping. Their New England customers have been clamoring for deliveries, and when the New York, New Haven & Hartford Railroad raised its embargo the producers shipped all the iron they could to relieve New England, whereon consumers in other districts began to complain. Two lots, each of 500 tons, of Southern No. 2 have been placed in the week at \$25, Birmingham, equal to \$29.53, Philadelphia, and \$29.85 at nearby points. Buffalo iron is

held at \$35, furnace (freight to Philadelphia, \$2.58), and small sales have been made at this price. Standard Bessemer is quoted at \$37.50 to \$38, furnace, with less desirable iron selling down to \$36, furnace. It is subject to a heavy export demand. A few hundred tons of basic have been taken at \$30, furnace. Standard low phosphorus ranges from \$52 to \$55, delivered, according to specifications and delivery. Copper-bearing low phosphorus ranges from \$50 upward. Practically all the buying of the past week has been of small miscellaneous lots for early shipment. Quotations for standard brands delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Pa. No. 2 X foundry.....	\$29.50 to \$30.50
Eastern Pa. No. 2 plain.....	29.00 to 30.00
Virginia No. 2 X foundry.....	29.00 to 30.00
Virginia No. 2 plain.....	28.75 to 29.75
Gray forge	28.25 to 28.75
Basic	30.00
Standard low phosphorus	52.00 to 55.00

Plates.—The mills are gradually approaching a uniform high level. One large producer, who is sold up to the last quarter, quotes 4.159c., Philadelphia, on universal plates, 5.159c. on tank steel and 6.159c. on ship plates. For ship plates it has quoted up to 6.659c., Philadelphia. The foreign demand is as strong as ever, one would-be Italian purchaser asking for a quotation on 4000 to 5000 tons of ship steel regardless of delivery or other conditions. Two other mills ask 4.909c., Philadelphia, for tank plates, but are in no position to quote on ship plates for any delivery they care to consider.

Bars.—A mill which has been out of the market for several months is taking business for the second quarter on plates, shapes and bars. Steel bars are quoted at 3.159c. to 3.409c., Philadelphia. For small miscellaneous lots up to 3.659c., Philadelphia, is quoted. For 2000 tons 3.409c., Pittsburgh, has been offered. Iron bars are active at 3.159c., Philadelphia, for carload lots. Steel reinforcing bars rolled from discarded shell steel have been sold at 2.75c.

Structural Material.—Three producers agree on 3.50c., Pittsburgh, or 3.659c., Philadelphia, as their minimum on shapes. No new fabricating jobs are reported in this territory.

Billets.—Open-hearth soft rerolling billets are unchanged at \$60 and forging steel at \$75 to \$80. Discarded shell steel is quoted at \$40 to \$45. It is taken both from the bloom and the bar, with most buyers preferring the latter. The high price of billets, coupled with the high ocean freight, operates to restrain exports to England, yet one export inquiry called for 8000 to 10,000 tons. At least one maker declined to quote on this inquiry.

Sheets.—The market is active. Local makers quote 4.409c. to 4.659c., Philadelphia, for No. 10 blue annealed. They are practically sold out for the first quarter, and well into the second.

Old Material.—The peace talk seems to have hit this trade harder than any other, probably for the reason that prices have advanced so rapidly in the last two or three weeks. Very little business has been done in the week, and quotations are more or less nominal. Incidentally, the week before Christmas usually is a quiet one. The dealers themselves are marking time until there is less uncertainty, and admit that they will not pay what they did two or three weeks ago. Quotations for delivery in buyers' yards in this district, covering eastern Pennsylvania and taking freight rates from 35c. to \$1.35 per gross ton, are as follows:

No. 1 heavy melting steel.....	\$24.00 to \$25.00
Old steel rails, rerolling	28.00 to 30.00
Low phos. heavy melting steel scrap.	33.00 to 36.00
Old steel axles (for export).....	45.00
Old iron axles (for export).....	45.00
Old iron rails	27.00 to 28.00
Old carwheels	22.50 to 23.50
No. 1 railroad wrought.....	27.00 to 28.00
Wrought-iron pipe	19.00 to 20.00
No. 1 forge fire	16.50 to 17.50
Bundled sheets	16.50 to 17.50
No. 2 busheling	13.00 to 14.00
Machine-shop turnings	13.50 to 14.00
Cast borings	14.50 to 15.00
No. 1 cast	21.00 to 22.00
Grate bars, railroad.....	16.00 to 16.50
Stove plate	17.00 to 17.50
Railroad malleable	18.50 to 19.00

Coke.—For furnace coke not considered high grade, \$8, oven, has been paid. Anticipating a falling off in production during the holidays, furnace managers have been endeavoring to hurry up their shipments on contract and to obtain spot coke when they can. The coke producers appear to be trying to give everyone a square deal by prorating their shipments. Prompt foundry is around \$9.50 per net ton at oven. Contract furnace is about \$4 to \$4.25 per ton at oven and contract foundry \$6 to \$6.50. Freight rates from the principal producing districts are as follows: Connellsville, \$2.05; Latrobe, \$1.85, and Mountain, \$1.65.

Chicago

CHICAGO, ILL., Dec. 19, 1916.

Though not lacking in the inquiry for finished steel for early shipment such as has been pressing for consideration right along, the past week was comparatively quiet with respect to business closed. Some hesitancy has been introduced into the consideration of purchases for future delivery, but even this has not been pronounced. The inability of the mills to supply materials when desired, or their unwillingness to contract very far ahead, continues the strongest negative factor in checking purchases. The mills that have not yet opened their books for second quarter or second half deliveries are still being pressed with considerable persistence by their regular customers who desire to cover for those periods. The leading interest is not in position to accept further orders which contemplate delivery in 1917, although it seems likely that some additional car business will be accommodated in view of the exceptional need in that direction. The prices named on orders that have been taken for materials to be delivered promptly are steadily mounting and 6c., f.o.b. mill, has been paid for tank plates, though an advance of \$5 per ton by one of the large independents last week brought its quotation only to 4.50c. The contract quotations of the largest interest remain unchanged. Buying of pig iron was less active and prices continue at the level last quoted. In the scrap market a well defined reaction made itself felt and, on offerings by sellers of scrap, prices were generally lower, but the situation is so sensitive that the appearance of firm inquiry might easily harden the market.

Pig Iron.—Domestic buyers displayed little interest in further purchases last week and for last half delivery appeared to be somewhat more cautious, though one sale of 1000 tons of Northern iron at \$30 for that delivery is noted. One of the large Southern interests which had been out of the market for some time found that offerings of last half iron on the basis of \$23, Birmingham, were not considered especially attractive and comparatively few sales were made. For prompt shipment, a stronger market tone prevails, both for the reason that first half iron is well sold up and because melters generally are using iron even more rapidly than it can be shipped to them. Sales of spot and prompt iron in small lots from the South are noted at prices ranging from \$23 to \$25, f.o.b. Birmingham. In the North there is very little first half iron remaining to be disposed of and quotations range from \$28 to \$30, depending upon the silicon and phosphorus content. For Lake Superior charcoal iron, we quote delivery prices at Chicago to include a freight rate of \$1.75. The following quotations are for iron delivered at consumers' yards, except those for Northern foundry, malleable Bessemer and basic irons, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton.

Lake Superior charcoal, Nos. 2 to 5..	\$31.75 to \$32.75
Lake Superior charcoal, No. 1.....	32.25 to 33.25
Lake Superior charcoal, No. 6 and	
Scotch	32.75 to 33.75
Northern coke foundry, No. 1.....	30.50
Northern coke foundry, No. 2.....	30.00
Northern coke foundry, No. 3.....	29.50
Northern high phosphorus foundry.....	28.00
Southern coke No. 1 f'dry and 1 soft	27.50 to 28.50
Southern coke No. 2 f'dry and 2 soft	27.00 to 28.00
Malleable Bessemer	30.00
Basic	30.00
Low phosphorus	40.00
Silvery, 8 per cent.....	35.50 to 36.00
Bessemer ferrosilicon, 10 per cent....	40.50 to 42.50

Rails and Track Supplies.—Although such important buyers of rails as the Pennsylvania Lines, Rock Island,

Baltimore & Ohio, Chesapeake & Ohio, Chicago & Eastern Illinois, Northern Pacific and others have not yet arranged for their requirements in 1918, there was in the past week, aside from the outstanding inquiry from the Pennsylvania, no additional inquiry. It would not be surprising to find some of the railroads seeking a preference for steel going into cars over that to be rolled into rails. Quotations are as follows: Standard railroad spikes, 3.50c. to 3.60c., base; track bolts with square nuts, 4c. to 4.50c., base, all in carloads, Chicago; tie-plates, \$55 to \$60, f.o.b. mill, net ton; standard section Bessemer rails, Chicago, \$38, base; open hearth, \$40; light rails, 25 to 45 lb., \$44; 16 to 20 lb., \$45; 12 lb., \$46; 8 lb., \$47; angle bars, 2.25c.

Structural Material.—The Nickel Plate Railroad is understood to have closed with the Pullman Company for 750 gondolas, but of the remaining inquiry pending no other portions are understood to have been closed. Contracts placed last week with the fabricators include 1130 tons for the Calumet & Hecla Mining Company, Lake Linden, Mich., taken by the American Bridge Company; 250 tons for the Utah Copper Company, taken by the Kansas City Structural Steel Works, and three small jobs for a total of 500 tons. Users of plain material find little steel to be had for delivery even as far away as the third quarter, and for such steel from 3.25c. to 3.50c. is being asked. While most of the mills have not yet opened their books for the second half and others not even for the second quarter, this fact is without much significance in that deliveries within those periods are not likely to be available even when the books are opened. We quote for Chicago delivery of structural steel from mill 3.189c. to 3.439c.

We quote for structural steel out of jobbers' stocks for Chicago delivery 3.70c.

Plates.—The plate mills that have been taking orders for early delivery report little or no cessation in the flow of inquiry upon which they are asked to quote. Quotations as high as 6c., f.o.b. mill, intended to operate as a check upon buying, have accomplished little, and one order for 1200 tons of tank plates is noted as placed at that price. For delivery in 30 to 60 days, tank plates can be had, however, on the basis of 4.50c., Pittsburgh. We quote for Chicago delivery of plates from mill, at its convenience, 3.689c.; for prompt shipment, 4.689c. to widths up to 72 in., and for wide plates, 4.939c. to 5c.

We quote for Chicago delivery of plates from jobbers' stocks, 4.35c.

Sheets.—Inquiry for sheets in all grades persists in large volume, regardless of prices, and many of the mills are in or out of the market from week to week, so rapidly is the small tonnage absorbed they have to offer from time to time. We quote, for Chicago delivery, No. 10 blue annealed, 4c. to 4.50c.; box annealed, No. 16 and lighter, 4.50c. to 5c.; No. 28 galvanized, 6.50c. to 7c. These quotations are minimum prices for contracts. Early shipment quotations are \$5 to \$10 per ton higher.

Further advances in the prices of galvanized sheets from store have been announced and we quote for Chicago delivery out of stock, regardless of quantity, as follows: No. 10 blue annealed, 4.25c.; No. 28 black, 4.75c.; No. 28 galvanized, 7c.

Bars.—The price of iron bars is now generally quoted on the basis of 3c., Chicago, with more business offered than mills can comfortably accommodate. Hard steel bars are likewise held at 3c., and the scarcity of rerolling rails is the occasion of especially conservative selling policies. There is a miscellaneous demand for soft steel bars for reinforcing purposes. We quote mill shipment, Chicago, as follows: Bar iron, 3c.; soft steel bars, 3.089c. to 3.439c.; hard steel bars, 3c.; shafting, in carloads, 20 per cent off; less than carloads, 15 per cent off.

We now quote store prices for Chicago delivery as follows: Soft steel bars, 3.60c.; bar iron, 3.60c.; reinforcing bars, 3.60c., base, with 5c. extra for twisting in sizes $\frac{1}{2}$ in. and over and usual card extras for smaller sizes; shafting list plus 5 per cent.

Rivets and Bolts.—There is enough new business in both rivets and bolts, emanating, particularly in the case of the former, from shipbuilding activity, to estab-

lish firmly existing contracts. We quote as follows: Carriage bolts up to $\frac{1}{2}$ x 6 in., rolled thread, 50; cut thread, 40-7½; larger sizes, 35; machine bolts up to $\frac{1}{2}$ x 4 in., rolled thread, with hot pressed square nuts, 50-5; cut thread, 40-10-5; large size, 40; gimlet-point coach screws, 50; hot pressed nuts, square, \$2.60 off per 100 lb.; hexagon, \$2.60 off. Structural rivets, $\frac{1}{4}$ to $1\frac{1}{4}$ in., 4.15c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

Store prices are as follows: Structural rivets, 4.50c.; boiler rivets, 4.50c.; machine bolts up to $\frac{1}{2}$ x 4 in., 40-10-5; larger sizes, 40; carriage bolts up to $\frac{1}{2}$ x 6 in., 40-7½; larger sizes, 35; hot pressed nuts, square, \$3. and hexagon, \$3 off per 100 lb.; lag screws, 50.

Cast-Iron Pipe.—Award has not yet been made of the pipe business outstanding at St. Paul, amounting to about 1500 tons, and no other sales of size are reported. We quote as follows, per net ton, Chicago: Water pipe, 4-in., \$44.50; 6-in. and larger, \$41.50, with \$1 extra for class A water pipe and gas pipe.

Wire Products.—Manufacturers report that conditions with respect to demand and to the available supply of wire in its principal forms point strongly to a further advance in prices. In domestic channels the trade shows seasonal activity. We quote as follows per 100 lb.: Plain wire, Nos. 6 to 9, base, \$3.239; wire nails, \$3.189; painted barb wire, \$3.339; galvanized barbed wire, \$4.039; polished staples, \$3.339; galvanized staples, \$4.039; all Chicago.

Old Material.—What with the introduction of an element of hesitancy into the situation and the freer movement of scrap into the market, sellers of old material found themselves last week under the necessity of making concessions in order to move such scrap as they desired to dispose of. While buyers were themselves displaying little interest, considerable quantities of scrap were taken in at the lower prices offered. Weakness appeared especially pronounced in connection with rerolling rails, shoveling steel, wrought scrap and busheling. The market, however, is in a condition of pronounced sensitiveness and a disposition to buy on the part of any large user would doubtless restore prices to their previous level. Offerings of scrap are being made by the Soo, Vandalia, Lake Erie & Western, Chicago & Alton, Omaha, Great Northern and Union Pacific in the amount of about 14,000 tons. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

<i>Per Gross Ton</i>	
Old iron rails	\$29.00 to \$30.00
Relaying rails	32.00 to 33.00
Old carwheels	21.50 to 22.00
Old steel rails, rerolling	28.50 to 29.00
Old steel rails, less than 3 ft.	26.50 to 27.00
Heavy melting steel scrap	23.50 to 24.50
Frogs, switches and guards, cut apart	23.50 to 24.50
Shoveling steel	22.00 to 22.50
Steel axle turnings	14.00 to 14.50

<i>Per Net Ton</i>	
Iron angles and splice bars	\$29.50 to \$30.00
Iron arch bars and transoms	30.00 to 30.50
Steel angle bars	22.50 to 23.00
Iron car axles	38.00 to 39.00
Steel car axles	42.00 to 43.00
No. 1 railroad wrought	25.00 to 25.50
No. 2 railroad wrought	24.00 to 24.50
Cut forge	24.00 to 24.50
Pipes and flues	15.50 to 16.00
No. 1 busheling	18.00 to 19.00
No. 2 busheling	13.75 to 14.25
Steel knuckles and couplers	23.50 to 24.50
Steel springs	24.50 to 25.00
No. 1 boilers, cut to sheets and rings	15.00 to 15.50
Boiler punchings	20.50 to 21.00
Locomotive tires, smooth	25.00 to 26.00
Machine-shop turnings	10.25 to 10.75
Cast borings	9.50 to 10.00
No. 1 cast scrap	16.50 to 17.00
Stove plate and light cast scrap	12.75 to 13.25
Grate bars	13.50 to 14.00
Brake shoes	13.50 to 14.00
Railroad malleable	18.00 to 19.00
Agricultural malleable	15.50 to 16.00

The three new 75-ton open-hearth furnaces of the Ashland Iron & Mining Company, Ashland, Ky., will begin to make steel in January and the new plant will get into full operation shortly after. Fires have been started in the furnaces to dry them out. Work is under way on three more furnaces and the plans of the company provide for four additional. Four soaking pits will be installed instead of two, as originally planned. Construction of the plant was begun in April.

Cincinnati

CINCINNATI, OHIO, Dec. 20, 1916.—(By Wire.)

Pig Iron.—Buying is at a standstill, except for a few lots of special iron that are needed by different melters. Prices are unchanged. Southern furnaces are almost uniform in asking from \$24 to \$25, Birmingham basis, for first half shipment, but several of them are not averse to taking on business at \$23 for the last half. Some prompt Southern No. 2 foundry has been offered at \$23, Birmingham, but this only covers a comparatively small lot that has to be moved before Jan. 1, and most of it is loaded on cars. Hanging Rock producers are holding firm at \$30, Ironton, and there is no resale iron to disturb this quotation. In fact, contracts have been made for first half shipment at \$31. An Ohio melter bought approximately 1700 tons of Bessemer at a reported price of \$35 at furnace for shipment before July 1. The Ohio silvery irons are inactive, but practically all the furnaces in Jackson County have sufficient business booked to carry them almost through 1917. Lake Superior charcoal irons are off the market for nearby shipment. No inquiries are out for either malleable or basic. Based on freight rates of \$2.90 from Birmingham and \$1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft.	\$26.40 to \$28.40
Southern coke, No. 2 f'dry and 2 soft.	25.90 to 27.90
Southern coke, No. 3 foundry	25.40 to 27.40
Southern coke, No. 4 foundry	24.90 to 25.40
Southern gray forge	24.40 to 26.40
Ohio silvery, 8 per cent silicon	37.25 to 38.25
Southern Ohio coke, No. 1	31.76
Southern Ohio coke, No. 2	31.26
Southern Ohio coke, No. 3	30.76
Southern Ohio malleable Bessemer	31.26
Basic Northern	31.26
Lake Superior charcoal	28.70 to 29.70
Standard Southern carwheel	27.90 to 28.40

(By Mail)

Finished Material.—No changes in prices are to be noted. Mill and warehouse business are both fairly brisk, which is somewhat out of the ordinary for the near approach of the holidays. Jobbers state that they are still having calls for structural material in spite of the cold weather that has retarded building operations in the past week. It has not been definitely decided whether the rolling mills in this locality will shut down through the entire holiday season as heretofore, and it is understood that they have left this question with the men. The mill price of No. 28 black sheets is 5c., Cincinnati or Newport, Ky., and from 6.90c. to 7.15c. for No. 28 galvanized. We quote local store prices as follows: No. 10 blue annealed sheets, 4.40c.; steel bars and small structural shapes, 3.70c.; structural material, 3.80c., base; rounds and squares, 2 in. and over, 4.25c.; flat bars, 1 in. and over, 4.25c.; cold-rolled shafting, 10 per cent plus list; wire nails, \$3.40 per keg, base; barb wire, \$4.40 per 100 lb., base.

Old Material.—Quotations are unchanged. Buying has slackened considerably, but hesitancy of consumers to cover for their future requirements is said to be due principally to the fact that the rolling mills and foundries are fairly well supplied for the first half of next year, while the holiday season also can be considered as a factor in slowing up purchases at present. The following are dealers' prices, f.o.b. at yards, southern Ohio and Cincinnati:

<i>Per Gross Ton</i>	
Bundled sheet scrap	\$14.75 to \$15.25
Old iron rails	25.00 to 25.50
Relaying rails, 50 lb. and up	28.50 to 29.00
Rerolling steel rails	25.00 to 25.50
Heavy melting steel scrap	21.00 to 21.50
Steel rails for melting	21.00 to 21.50

<i>Per Net Ton</i>	
No. 1 railroad wrought	\$21.75 to \$22.25
Cast borings	7.00 to 7.50
Steel turnings	7.00 to 7.50
Railroad cast	16.50 to 17.50
No. 1 machinery cast	18.25 to 18.75
Burnt scrap	10.50 to 11.00
Iron axles	33.25 to 33.75
Locomotive tires (smooth inside)	27.00 to 27.50
Pipes and flues	14.00 to 14.50
Malleable cast	15.00 to 15.50
Railroad tank and sheet	12.00 to 12.50

Coke.—Little furnace or foundry coke has been sold for shipment to this territory in the past week. Some Wise County 72-hr. coke that was loaded on cars

brought \$10 per net ton at oven. Some Connellsville foundry coke was sold around \$9.50 for nearby shipment. For first half delivery all the way from \$6 to \$8 at oven is quoted on any kind of furnace coke and from \$6.50 to \$9 on foundry coke. Contracts for the entire year for furnace coke could be made at \$5 to \$6.50 and on foundry coke from \$5.50 to \$7.

Birmingham

BIRMINGHAM, ALA., Dec. 18, 1916.

Pig Iron.—Consumers anxious for spot iron have paid as high as \$25 f.o.b. furnaces in several instances. The usual quotation for the last half is \$23, with \$24 for the first half or spot. The majority of transactions in the week ended Dec. 16 were on the basis of \$23 for either delivery, the greater business booked being for the last half. Capacity is so well booked for the entire year that makers have marked up prices as much in the hope of staving off spot inquiries as for anything else; but the inquiry comes, and the advanced prices are paid. Some last half iron was sold at \$22.50, about the same amount as went at \$25 for immediate delivery. Export metal is going out of the district at the rate of about 35,000 tons per month to Great Britain alone, with some additional tonnage to Denmark and other countries. England takes care of her vessel room, so there is little trouble in that direction. Much of the movement is out of Mobile. The Republic Company's overhauled stack will not go in until the latter part of the month. Woodward will blow out a stack for relining. Movements of metal are gratifying. The Alabama Car Service Association reports total November movements of 92,600 cars, as compared with 78,000 cars in the preceding month and 83,000 cars in November, 1915. The record is within a few cars of the highest ever attained. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	\$23.50 to \$25.50
No. 2 foundry and soft	23.00 to 25.00
No. 3 foundry	22.50 to 24.50
No. 4 foundry	22.25 to 24.25
Gray forge	22.00 to 24.00
Basic	23.00 to 25.00
Charcoal	25.00 to 26.00

Cast-Iron Pipe.—Prices have advanced another \$2 per ton. Makers agree that the danger point has been reached, and look forward to a considerable falling off in new business. Only absolute needs are now being contracted for, postponement being the order of the day. This is the usual dull season, but high prices bid fair to accentuate it. Output has slightly decreased already. Demand for flange oil pipe is good. We quote, per net ton, f.o.b. pipe shop yards, as follows: 4-in., \$39; 6-in. and upward, \$26, with \$1 added for gas pipe and special lengths.

Old Material.—The scarcity of wrought scrap and the high prices obtained for it feature the old-material trade. Embargoes serve to keep the Southern supply at home, but for which it might go considerably higher. Much scrap has come into the market owing to the persistent gleanings of country and railroad yards. While Southern consumption is at its maximum, supply and demand are rather harmonious, and a mutual advantage is thus enjoyed by dealer and purchaser. Steel axles command as high as \$36 per ton, when obtainable in quantities. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old steel axles	\$34.00 to \$36.00
Old steel rails	20.00 to 21.00
No. 1 wrought	21.00 to 22.00
Heavy melting steel	17.00 to 18.00
No. 1 machinery cast	17.00 to 18.00
Carwheels	16.00 to 17.00
Tram carwheels	15.00 to 16.00
Stove plate and light	12.00 to 13.00

Coal and Coke.—Spot steam coal is bringing around \$2.50 to \$3 per net ton at mine to regular customers. Domestic coal is selling at \$5 in Birmingham. Fancy prices are obtained from new and rush customers. The car shortage is still acute, but hundreds of new cars are being rushed to the district, thus improving the situation. One standard beehive coke maker says his company sold 30 cars of coke recently for California,

Oklahoma and Texas, as well as locally, for \$10 per net ton. The Pacific demand is especially strong, owing to the desire to anticipate advanced freight rates. A furnace interest is selling its by-product coke at \$5 per ton. A small coke operator has contracted for his year's output with a Mexican smelter at \$6 per ton. Spot coke ranges from \$6 to \$10. Furnace coke, when obtainable, brings \$4.50 to \$5 at oven.

San Francisco

SAN FRANCISCO, CAL., Dec. 12, 1916.

The usual year-end contraction of business has been conspicuously absent. Merchants and other large buyers are seeking to cover their requirements for first and second quarters as far as possible by contracts, but while most mills are endeavoring to take care of regular customers, they are taking on very little outside business. New inquiries are numerous, both local and foreign, and a great deal of business that would ordinarily be attractive is being refused. Many buyers are drawing more heavily than usual on merchants' stocks, causing exceptional activity for this season.

Bars.—Many of the larger buyers have been placing steel-bar contracts with local mills for the first half of 1917, covering their principal requirements, at about 3.25c., which is much lower than anything can be had from the East. The demand from the Orient continues active, and considerable business is going through, though many of the orders have been placed with difficulty. The jobbing movement shows a tendency to increase. The high cost of structural shapes is causing a perceptible gain in reinforcing-bar business, though few really important orders are appearing. The jobbing price on small lots remains at 4.25c.

Structural Material.—Large contracts continue scarce, and many projects have been delayed on account of prices. The volume of important work in more or less definite prospect, however, continues to accumulate, and from present indications there should be considerable activity next year. It is announced that bids will be taken in March for the 10-story Mattson Building. Preliminary arrangements are under way for the 6-story Ogden Mills Building, and plans are under way for the S. F. Stock & Bond Exchange Building in the same district. The new building adjoining the Merchants' Exchange will be much larger than originally reported. Most local shops are fairly well occupied on small work. Fabricators are contracting ahead for plain material in a rather conservative way, but manufacturers are making liberal provision for the future.

Plates.—Routine needs are being covered well in advance, with provision in many cases for increased tonnage. There is a strong foreign demand, but outside buyers are in competition with local shipbuilders, and are unable to place much business here. Ship construction is proceeding about as fast as the arrivals of material will permit. No new tank or pipe business of special importance has appeared, but manufacturers in this line continue in the market, and the general distributive movement of tank and boiler plates is active, with a price on small lots of 5.15c.

Sheets.—A further advance in mill prices, with considerable actual difficulty in placing orders, has caused another rise in the local resale price of galvanized sheets, No. 28 being quoted at 7.84c. The movement is somewhat restricted, though there is a strong demand. Blue annealed sheets are moving well in a small way, but no special work requiring large tonnage has come up in the last fortnight.

Wrought Pipe.—While the rainy season usually curtails business in the oil country, inquiries are still coming from that section in good shape, the tonnage so far being very satisfactory. With oil still going rapidly out of storage, the outlook is favorable for new development. Merchant pipe remains comparatively inactive, with nothing to indicate increasing activity in the near future.

Cast-Iron Pipe.—There is no large buying now by

either corporations or municipalities, and it is expected that the high prices prevailing will have a deterrent effect. The town of Whittier, Cal., placed an order Dec. 4 for about 200 tons, and Santa Monica will take bids Dec. 18 for a small lot. Prices are quoted here at \$47 per net ton for 6-in., \$50 for 4-in., and \$1 extra for gas pipe.

Pig Iron.—There has been more buying for shipment before the first of the year to avoid the freight advance, with comparatively little contracting for extended delivery. Foundry operations are on a fairly large scale, with little fluctuation. Local values are rather uncertain, owing to the rapid advance in the East.

Coke.—Local values are too unsettled to quote at present, being contingent on Eastern changes. Buying has been fairly active, though the tonnage is hardly as large as that booked at the end of last summer.

Old Material.—The movement of steel melting scrap continues large, with rather more current buying than before, and prospects of further increase in requirements before long, though there is no shipping movement to distant markets. There is plenty of scrap scattered through the country, but accumulations are firmly held, being quoted at a general range of \$11 to \$14 per gross ton. Cast-iron scrap finds a ready market with the foundries at about \$16 per net ton.

The Rennerfelt electric steel furnace installed by Woods, Huddart & Gunn for the Samson Sieve-Grip Tractor Company, Stockton, Cal., is now in successful operation.

Buffalo

BUFFALO, N. Y., Dec. 18, 1916.

Pig Iron.—The market is somewhat quieter. While inquiry keeps up in fair volume, it is of a more desultory nature. Considerable demand is noted from melters who had previously contracted for their requirements but have had their supply curtailed through the inability of furnaces to make shipments owing to the shortage of coke, labor and railroad cars. Sales, however, are scant, owing to the unprecedented scarcity of iron to be found at this time not under contract and obtainable at the delivery periods desired by the consumers. Very little resale iron is left in the market—hardly worth taking into account—there being only 1500 tons on hand here at present, of which only 500 tons is now available, and is held at \$35 per ton flat, although a small lot was sold 10 days ago at \$31. The price situation is as unusual as the sold-up condition of the furnaces. Grade schedules have given way to a flat price of \$35 per ton, irrespective of grade differentials or deliveries. One leading producing interest is out of the market entirely and a second announces that it has very little, if anything, to sell for the next six months. Some buyers are disposed to hold off, believing that the stiffness of the situation may later be eased. There are indications, however, that prices may go to higher levels. One sale of a small amount of foundry iron was reported today at \$35.50 at furnace. The lack of a spread on grade differentials necessitates quoting the price of any kind of coke iron, f.o.b. furnace, Buffalo, at \$35. Charcoal iron sales are subject to prices quoted by producers on a basis of analysis, tonnage and deliveries required. No open quotations are being made at present time.

Finished Iron and Steel.—Quieter conditions are noted for some weeks. Sellers are not pressing sales and buyers seem inclined to wait until January before making further effort to purchase. Quite a number of the largest users of steel are now taking inventory and holiday conditions are in evidence. Prices for most finished products remain largely nominal. Sheet prices have strengthened. Mills are quoting 4.50c. on No. 28 black sheets, with some sales reported at 5c. Galvanized sheets have been advanced to a minimum of 6.25c., some sellers asking 6.50c. The demand for billets has been so heavy that one producing interest in this market has contracted to the extent of its capacity for the first half of 1917, and is not sell-

ing beyond that period. The Strong Steel Foundry Company has awarded contract to the Progressive Structural Steel Company for 200 tons of steel for an addition to its foundry. The John W. Cowper Company, Buffalo, which has the general contract for a laboratory building, requiring 700 tons, and for an ice-machine building, power plant and boiler house, 700 tons, all at the plant of the Schoellkopf Aniline & Chemical Works, Buffalo, has sublet the steel work to the Ferguson Steel & Iron Company, this city. The Cowper Company has also sublet to the Ferguson Company 100 tons for a new plant for the Transmission Ball Bearing Company, for which it has the general contract. Architect Neal Dunning, Builders Exchange Building, Buffalo, will soon call for bids for 600 tons required for school buildings at Lackawanna City, N. Y., and for 200 tons for a building for the Lackawanna Trust Company, Lackawanna City.

Old Material.—A succession of advances has taken place since last report in many commodities in the scrap list. Heavy melting steel is now being quoted at \$26 to \$27 and iron and steel axles are up to \$45. The peace talk has not as yet materially affected the market situation, although a slight lull in buying is now noted. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel.....	\$26.00 to \$27.00
Low phosphorus.....	32.00 to 34.00
No. 1 railroad wrought.....	30.00 to 31.00
No. 1 railroad and machinery cast.....	23.00 to 24.00
Iron axles.....	45.00
Steel axles.....	45.00
Carwheels.....	23.00 to 24.00
Railroad malleable.....	23.00 to 24.00
Machine shop turnings.....	11.50 to 12.00
Heavy axle turnings.....	17.50 to 18.00
Clean cast borings.....	11.50 to 12.00
Iron rails.....	25.00 to 26.00
Locomotive grate bars.....	15.50 to 16.00
Stove plate.....	16.00 to 16.50
Wrought pipe.....	17.00 to 17.50
No. 1 busheling scrap.....	21.50 to 22.50
No. 2 busheling scrap.....	15.00 to 15.50
Bundled sheet scrap.....	15.00 to 16.00

New York

NEW YORK, Dec. 20, 1916.

Pig Iron.—Pig iron inquiry has fallen off the past week though the preceding week was by no means active. Only small lots are being put before the trade, and these are mostly for delivery in the first half. Buffalo furnaces are reported to be asking \$35 at furnace for all grades with the possible exceptions of No. 3 foundry and forge iron. In New England the activity is mostly by way of pressing for delivery of iron, the embargo by the railroads there having been lifted on Dec. 10. A number of furnaces are behind on their schedules, but they are confronted with requests by some foundries for the anticipation of shipments, in the effort of the latter to guard against traffic derangements due to winter weather. In the Lehigh Valley one or two furnaces have banked again because of coke shortage and in another case a shutdown was only averted by an increase in wages. Of recent buying by the Baldwin Locomotive Works only 500 tons taken by a Virginia furnace can be traced. The largest inquiry that has come up in this district is for 2000 tons of steel making iron from a New Jersey interest. We quote at tidewater for early delivery: No. 1 foundry, \$30 to \$31; No. 2X, \$29.50 to \$30.50; No. 2 plain, \$28.50 to \$29.50; Southern iron at tidewater, \$29 to \$30 for No. 1 and \$28 to \$29 for No. 2 foundry and No. 2 soft.

Ferroalloys.—Sales of about 7000 tons of British ferromanganese at \$164, seaboard, for delivery in the last half of 1917 have been made in the past week, after a period in which very few sales of this product have been made. Most representative of British makers are out of the market for the first half of 1917 and have been for some time, one broker having sold practically all of the supply available for the first half of 1917 some months ago at \$175, seaboard. Receipts from abroad in November were 7410 tons, but the indications are that the December receipts will be less. In fact, there has been a gradual decline since September. While the quotation for domestic ferromanganese has been advanced to \$175, delivered, about 3000 tons has been sold

in the past week at \$165, delivered, besides 300 tons for export. Inquiries are not large outside of one for about 2500 tons for fairly early delivery. The spiegeleisen market is more active and firmer at \$55 to \$60, furnace, for the 20 per cent grade for forward delivery, principally for first quarter. Besides a sale of about 500 tons for export at not less than \$60 per ton there have been sales of about 3000 tons for delivery in the first quarter. The market for ferrosilicon, 50 per cent, continues strong and active at \$99 to \$100 for forward delivery, with considerably higher prices obtained for much needed material. Previous indications of a scarcity in the coming year have been recently strengthened by information to the effect that a large producer in this country, with which many important steel companies have large contracts, is likely in the near future to have its supply of electric power considerably lessened. It is reported that this interest has already declined to renew one important contract for next year.

Finished Iron and Steel.—Peace talk in connection with the European war has not apparently affected inquiry from abroad in any way and the domestic market is normal for the holiday season. The disturbing elements are the shortage of cars and, as the result, scarcity of fuel, including also natural gas, particularly at Pittsburgh and Youngstown, with embargoes against shipments to different points. Opinions are much mixed as to the trend of prices in the event of advanced peace negotiations and cessation of warfare, with perhaps a preponderance believing that prices will remain strong through 1917. This is predicated on the needs abroad for ship material and for rails both under direct negotiations and obtainable by substitution if shell steel is not taken; the occupation of rolling mills on this account is expected to maintain prices in other lines. At the moment structural steel is not moving fast, but it now appears that fabricators have four months' work on their books based on ideal running conditions, which with inefficient and scarce labor represent six months' work. Some mills have put their minimum for shapes at 3.50c., Pittsburgh, but 3.25c. is still obtainable. The structural work lately put under contract includes 900 tons for the Dreicer loft, Fifty-seventh Street, and 200 tons for an eye, ear and nose hospital, both to Harris, Silver, Baker Company; 1200 tons for the Niagara Chemical Company, Perth Amboy, N. J., to the Hedden Iron Construction Company; 1600 tons for the addition to the power house of the Boston Edison Company at South Boston to the New England Structural Company; 750 tons for bridge work for the Baltimore & Ohio to the Toledo Bridge & Crane Company and the Fort Pitt Bridge Works, and 250 tons for the De Laval Steam Turbine Company, Trenton, N. J., to Lewis F. Shoemaker & Co. It is believed that the American Bridge will supply the Baltimore & Ohio pier shed at Baltimore, 2600 tons, and that the McClintic-Marshall Company will furnish the 7000 tons for the New York Shipbuilding Company. The Maine Central has decided not to purchase the 2200 tons of bridge work on account of high prices, believing that it can wait a year or so and buy for less money. We quote mill shipments of shapes in two to five months at 3.419c. to 3.669c., New York, and warehouse shipments at a minimum of 3.75c., New York. We quote universal and ordinary tank plates at 4.169c. to 4.669c., New York, but Lloyd specification plates at 5.169c. to 6.169c., with little available before the third quarter of 1917 and for plates in the fourth quarter of 1917 and the first quarter of 1918 at 3.669c., New York. Out of store we quote 4.75c., New York, for plates under 36 in. in width and 5c. on wider plates. We quote mill shipments of steel bars at 3.069c. to 3.419c., New York, the lower price for indefinite delivery and the higher for small quantities in, say, three months. We quote mill shipments of bar iron at 3.169c., New York. Out of warehouse iron bars are 3.50c. and steel bars 3.75c., New York.

Cast-Iron Pipe.—Greater activity prevails than for the past two or three weeks. Municipalities in New England are taking up the purchase of supplies for next year and some lettings are now being advertised while others are known to be in course of preparation.

The city of Holyoke, Mass., will open bids on 200 tons on Thursday, Dec. 21, and Boston on 2500 tons on Tuesday, Dec. 26. Private buying is running much beyond expectations for the season. Prices are firmly held on the basis of \$41.50 per net ton, tidewater, for carload lots of 6-in., class B and heavier, with class A and gas pipe taking an extra of \$1 per ton.

Old Material.—A decided change took place when announcement was made of Germany's overture for peace. Inquiries fell off and negotiations were checked, while prices on some commodities weakened perceptibly. The underlying strength of the market, however, is shown by the fact that on most classes of old material prices have been maintained. The discontinuance of the blast-furnace demand for borings and turnings caused a sharp decline in these classes of scrap. Other adverse influences than peace talk were new embargoes at some of the eastern Pennsylvania works and the higher demurrage charges now being imposed. Brokers quote buying prices about as follows to local dealers and consumers, per gross ton, New York:

Heavy melting steel scrap (for eastern Pennsylvania shipment).....	\$20.00 to \$20.50
Old steel rails (short lengths) or equivalent	22.00 to 22.50
Relaying rails	37.00 to 38.00
Rerolling rails	27.50 to 28.00
Iron and steel car axles (for export)	45.00 to 47.00
No. 1 railroad wrought	25.00 to 26.00
Wrought-iron track scrap	22.00 to 22.50
No. 1 yard wrought, long	22.00 to 22.50
Light iron (nominal)	6.50 to 7.00
Cast borings (clean)	11.00 to 11.50
Machine shop turnings	9.50 to 10.00
Mixed borings and turnings	7.00 to 7.50
Wrought pipe (not galvanized or enameled)	16.50 to 17.00

Cast scrap appears to be in somewhat better condition than steel scrap. Foundries have been buying quite well and further inquiries are in hand. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast	\$22.00 to \$22.50
No. 2 cast	19.00 to 19.50
Stove plate	15.50 to 16.00
Locomotive grate bars	15.50 to 16.00
Old carwheels	21.50 to 22.00
Malleable cast (railroad)	18.00 to 18.50

British Steel Market

Ferromanganese Selling Higher—Italy Buying American Billets

(By Cable)

LONDON, ENGLAND, Dec. 20, 1916.

The Cleveland pig iron market is quieter but firm, and conditions in hematite iron are easier. Tin plates are quoted at 34s. 6d. and ferromanganese is more active, with £38 paid for delivery in Spain. Business in semi-finished steel is difficult. Italy has bought 5-in. billets for January-February delivery at \$63 f.o.b. Baltimore. We quote as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 34s. 6d. against 34s. last week.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £19 5s. against £20 a week ago.

Hematite pig iron, f.o.b. Tees, 142s. 6d., compared with about 140s. a week ago.

Sheet bars (Welsh) delivered at works in Swansea Valley, £15 5s. nominal.

Ferromanganese, £36 to £38 against £36 a week ago.

Ferrosilicon, 50 per cent, c.i.f., £30 against £27 last week.

What is practically the new furnace of the Pulaski Iron Company, Pulaski, Va., went into blast Dec. 18, and at last reports was working smoothly. The stack is new and the stoves were installed but a few months ago. A General Electric turbo-blower is a part of the new equipment, also an Ingersoll-Rand blower of the same type. An electrically-operated skip hoist is new, the boiler capacity has been increased and other improvements have been made. The furnace has a capacity of 300 tons a day.

St. Louis

ST. LOUIS, Mo., Dec. 18, 1916.

Pig Iron.—The fact that all large consumers and a considerable number of the smaller users had covered for a considerable period ahead gave little opportunity for the peace talk to affect the market at this point. Buying during the week was in small lots, ranging from 500 tons downward. The sales made showed no weakness in price. Some call was noted for fluorspar at \$20, and there was a sale of ferromanganese, about 30 tons, at \$164.50, while \$175 is the present quotation at this point.

Finished Iron and Steel.—The pressure for delivery of contracted steel was quite heavy during the week, and consumers are urging forward their specifications because of accentuated needs to meet demand, particularly on structural material. An inquiry for 2500 tons of standard section steel rails appeared but was not closed. This is for 1918 delivery. Movement out of warehouse has continued good, with prices firmly held. We quote for stock out of warehouse as follows: Soft steel bars, 3.65c.; iron bars, 3.60c.; structural material, 3.65c. to 3.75c., according to size and weight; tank plates, 4.30c.; No. 10 blue annealed sheets, 4.30c.; No. 28 black sheets, cold-rolled, one pass, 4.90c.; No. 28 galvanized sheets, 7.10c.

Old Material.—The peace talk had a temporary effect and for the moment weakened prices, but at the close of the week and to-day the figures quoted were steady for the most part. This being the inventory period and the holidays near at hand, the situation is likely to remain rather quiet until after the first of the year. Previous to the developments of the past week there had been some considerable buying by Eastern and Chicago interests. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton

Old iron rails	\$28.00 to \$28.50
Old steel rails, rerolling	30.00 to 31.00
Old steel rails, less than 3 ft.	30.00 to 31.00
Relaying rails, standard section, subject to inspection	35.00 to 36.00
Old carwheels	22.00 to 22.50
No. 1 railroad heavy melting steel scrap	25.50 to 26.00
Heavy shoveling steel	21.50 to 22.00
Ordinary shoveling steel	18.50 to 19.00
Frogs, switches and guards cut apart	25.50 to 26.00
Ordinary bundled sheet scrap	14.50 to 15.00

Per Net Ton

Iron angle bars	\$26.00 to \$26.50
Steel angle bars	23.50 to 24.00
Iron car axles	37.50 to 38.00
Steel car axles	37.50 to 38.00
Wrought arch bars and transoms	27.50 to 28.00
No. 1 railroad wrought	26.00 to 26.50
No. 2 railroad wrought	25.00 to 25.50
Railroad springs	24.50 to 25.00
Steel couplers and knuckles	25.50 to 26.00
Locomotive tires, 42 in. and over, smooth inside	28.00 to 28.50
No. 1 dealers' forge	20.00 to 20.50
Cast-iron borings	10.50 to 11.00
No. 1 busheling	19.00 to 19.50
No. 1 boilers, cut to sheets and rings	15.00 to 15.50
No. 1 railroad cast scrap	15.50 to 16.00
Stove plate and light cast scrap	11.00 to 11.50
Railroad malleable	17.00 to 17.50
Agricultural malleable	14.00 to 14.50
Pipes and flues	16.50 to 17.00
Heavy railroad sheet and tank scrap	15.50 to 16.00
Railroad grate bars	13.00 to 13.50
Machine shop turnings	11.00 to 11.50
Heavy axle and tire turnings	12.50 to 13.00

Iron and Industrial Stocks

NEW YORK, Dec. 20, 1916.

With the subsidence of the furious general demand for stocks and the disposition of values to recede, it needed only such a mild movement toward peace as that of Germany to precipitate a violent decline. This decline has been termed a "peace panic," which seems a most appropriate description of the heavy fall that took prices of all stocks owing their advanced value to the war down to the lowest point in a great many months. The movement went through its first severe spasm on Friday, Dec. 15, after which there was some recovery, followed by another and even sharper collapse on Tuesday of this week. The range of prices on

active iron and industrial stocks from Wednesday of last week to Tuesday of this week was as follows:

Allis-Chal. com.	26	- 32	com.	118 1/2 - 123 1/2
Allis-Chal. pref.	85 1/2	- 89	Int. Har. of N. J.	
Am. Can. com.	48 1/2	- 57 1/2	pref.	120
Am. Can. pref.	109 1/4	- 114	Int. Har. Corp.	
Am. Car & Fdy. com.	65 1/2	- 72 1/2	com.	81 - 87
Am. Car & Fdy. pref.	116	- 117 1/2	Int. Har. Corp.	
Am. Loco. com.	78	- 87 1/2	La Belle Iron.	
Am. Loco. pref.	106 1/2	- 106 1/2	com.	78 - 86
Am. Ship. com.	62	- 64 1/2	Lacka. Steel.	84 - 102 1/2
Am. Ship. pref.	95	- 96 1/2	Lake Sup. Corp.	18 - 25
Am. Steel Fdries. com.	63	- 69 1/2	Midvale Steel.	59 - 64 1/2
Bald. Loco. com.	65	- 76 1/2	Nat. En. & Stm.	
Bald. Loco. pref.	100 1/4	- 102 1/4	com.	30 - 34
Beth. Steel. com.	52 1/2	- 59 1/2	Nat. En. & Stm.	
Beth. Steel. pref.	145	- 147	pref.	99 1/2
Cambria Steel.	120	- 125	N. Y. Air Brake.	149 - 160
Carbon Stl. com.	97	- 114	Nova Scotia Stl.	126 - 141
Central Fdry. com.	23	- 30	Pitts. Steel.	pref. 102 1/4 - 103
Central Fdry. pref.	39	- 47 1/2	Pressed Stl. com.	74 - 81
Chic. Pneu. Tool.	71 1/2	- 78 1/2	Pressed Stl. pref.	102 - 105
Colo. Fuel.	44 1/2	- 52 1/2	Ry. Steel Spring.	
Cruc. Steel. com.	63 1/2	- 78	com.	50% - 56 1/2
Cruc. Steel. pref.	111	- 119 1/2	Ry. Steel Spring.	
Deere & Co. pref.	99	- 99 1/2	pref.	101 - 101 1/2
Driggs-Seabury	50	- 69 1/2	Republic. com.	75 - 84 1/2
Gen. Electric.	168 1/2	- 177	Republic. pref.	105 - 115
Gt. No. Ore Cert.	38 1/2	- 42 1/2	Sloss. com.	60 - 75
Gulf States Steel.	120	- 159	Sloss. pref.	100
1st pref.	108		Un. Alloy Steel.	48 1/4 - 53 1/2
Gulf States Steel.	120	- 159	U. S. Pipe. com.	21 - 24 1/2
2nd pref.	140		U. S. Pipe. pref.	59 1/2 - 60 1/2
Harb-Walk. Refrac.			U. S. Steel. com.	109 1/2 - 120 1/2
pref.	107	- 108 1/2	U. S. Steel. pref.	118 1/2 - 121 1/2
Int. Har. of N. J.			Va. I. C. & Coke.	49 - 57
			Warwick	9 1/2
			Westing. Electric	51 1/2 - 58 1/2

Dividends

The E. W. Bliss Company, regular quarterly, 1 1/4 per cent and extra 100 per cent on the common stock, and regular quarterly, 2 per cent on the preferred, payable Dec. 23.

The Allis-Chalmers Mfg. Company, regular quarterly, 1 1/2 per cent and 1 1/2 per cent on back dividends on the preferred stock, payable Jan. 15. Dividends in arrears on the preferred now amount to 10 per cent.

The Transue & Williams Steel Forging Corporation, initial quarterly, \$1 a share, payable Jan. 11.

The Brier Hill Steel Company, regular quarterly, 1 1/2 per cent, and extra, 2 per cent, on the common stock.

The Empire Steel & Iron Company, 3 per cent on the preferred, payable Jan. 1.

The Ingersoll-Rand Company, \$20 a share on the common, payable Dec. 28.

The Packard Motor Car Company, increased dividend from 7 per cent to 8 per cent on the common stock. Quarterly 2 per cent, payable Feb. 1.

The American Brake Shoe & Foundry Company, regular 8 per cent on the preferred stock, payable in four quarterly instalments of 2 per cent each, on Dec. 30, March 31, June 30 and Sept. 29 next and similarly a regular 7 per cent on the common stock, in four quarterly instalments of 1 1/4 per cent each. Also an extra of 2 per cent on the preferred, payable Dec. 30.

The Torrington Company, regular quarterly 3 per cent and extra 1 per cent, payable Jan. 3.

The American Laundry Machinery Company, regular quarterly, 1 1/4 per cent on the preferred stock, payable Jan. 15.

The American Seeding Machine Company, regular quarterly, 1 per cent, on the common stock, and 1 1/2 per cent on the preferred stock, payable Jan. 15.

The American Rolling Mill Company, regular quarterly, 2 per cent, and extra, 1 per cent, on the common stock, and 1 1/2 per cent on the preferred stock, all payable Jan. 15.

The Canadian Crocker-Wheeler Company, regular quarterly, 1 1/4 per cent each on the common and preferred stock, payable Dec. 31.

The Canadian Locomotive Company, regular quarterly, 1 1/4 per cent, on the preferred stock, payable Jan. 31.

The J. I. Case Threshing Machine Company, regular quarterly, 1 1/4 per cent on the preferred stock, payable Jan. 2.

The International Harvester Company of New Jersey, regular quarterly, 1 1/4 per cent, on the common stock, payable Jan. 15.

The National Enameling & Stamping Company, regular quarterly, 1 1/4 per cent, on the preferred stock, payable Dec. 31.

The Scovill Mfg. Company, regular quarterly, 2 per cent, extra, 10 per cent, payable Jan. 1, and special of 25 per cent in Anglo-French bonds, payable Jan. 5.

The Standard Sanitary Mfg. Company, extra 1 per cent on the common stock, payable Dec. 23.

The Republic Iron & Steel Company, initial dividend of 1 1/2 per cent on the common stock, payable Feb. 1.

The Crucible Steel Company of America, extra, 2 per cent, on the preferred stock, on account of deferred dividends, payable Jan. 31.

The Standard Screw Company, extra, 20 per cent on the common stock, in addition to the regular semi-annual dividends of 3 per cent on the common and A preferred stocks, and 3 1/2 per cent on the B preferred, all payable Jan. 2.

The Trumbull Steel Company, regular quarterly, 1 1/4 per cent, extra, 2 per cent, on the common stock, and regular quarterly, 1 1/4 per cent on the preferred, all payable Jan. 1.

The Ohio Iron & Steel Company, regular monthly, 1 per cent, and extra, 5 per cent, payable Jan. 1, making 17 per cent declared this year.

Metal Markets

The Week's Prices

Dec.	Cents Per Pound for Early Delivery					
	Copper, New York	Lake	Tin, Electro	New York	Lead	Spelter
13.....	34.25	34.25	42.87½	7.80	7.70	11.75
14.....	34.00	34.00	42.75	7.75	7.65	11.50
15.....	33.50	33.50	42.87½	7.50	7.40	10.75
16.....	33.50	33.50	42.50	7.50	7.40	10.50
18.....	32.50	32.50	42.50	7.50	7.40	10.50
19.....	32.50	32.50	42.37½	7.50	7.40	10.25

NEW YORK, Dec. 20, 1916.

Copper is quiet and lower, with all concerned inclined to sit still and await developments. Tin is lower after a quiet week. Lead conditions have been reversed, and it is being offered at lower prices. Spelter has continued to decline. Antimony is dull, but prices are firm.

New York

Copper.—The peace talk of recent days brought a halt to business in all the metals. In copper there has been a little inquiry, with some resultant sales, although most sellers and consumers have been satisfied to simply watch the situation. Despite the sold-up condition of the producers, on which so much stress has been laid of late, copper began to come out rather freely, following the German peace proposal. Second hands, including some consumers, have been offering the metal. One offering of last week consisted of 1,000,000 lb. of prompt prime Lake which a mill was willing to let go at 30c. It is predicted that most of the business in the next few months will be done by second hands, who are making the market to-day. Lake and electrolytic were to be had yesterday at 32.50c. for January delivery, electrolytic being sold at that figure. First quarter was offered yesterday at 31.50c. With all the change in metal prices, the quotations for brass and copper rolling-mill products are unchanged. A buyer who was in the market yesterday stated that he would not close until he was sure of a prospective contract. The London market for spot electrolytic yesterday was £161, against £168 a week previous, the decline being a manifestation of Great Britain's purpose to fix the price of copper and to control its consumption. The exports this month, including yesterday, are fair, amounting to 14,040 tons.

Tin.—The market has been at almost a complete standstill except on two days of the week, when moderate quantities were taken. On Dec. 18 a few buyers took about 200 tons, it being understood that the metal was needed to cover old contracts in cases where shipments had failed to arrive because of the difficulty in getting licenses to ship. Yesterday about 100 tons changed hands. The trade considers that the coming of peace would be a bull point for tin, inasmuch as a much wider market would then be possible. New York prices have continued to decline, the quotation yesterday being 42.37½c. for spot Straits. The arrivals this month total 1070 tons, and there is afloat 6393 tons.

Lead.—Since Dec. 18 the market has undergone a complete change, as on that day it was strong at 8c., New York, and higher, with very little metal being offered, whereas yesterday there were plenty of offerings at 7.50c., New York, this being the price of all interests. Last Tuesday second hand lots were offered freely at concessions, and likewise on Wednesday, at still lower figures. On Friday the market dropped \$5 per ton—to 7.50c., thereby wiping out all premiums. As was the case with copper, sellers who were supposed to be sold out discovered they had metal to sell. The St. Louis price yesterday was about 7.40c. The London spot quotation yesterday was unchanged at £30 10s. The exports this month, including yesterday, were small, amounting only to 122 tons.

Spelter.—On Monday, nearby spelter sold at 10c., New York, for delivery to Perth Amboy, N. J., which is about equal to 9.75c., St. Louis. Prompt metal ranges

from 10c. to 10.50c., St. Louis, for December, and 9.75c. to 10.25c. for first quarter, the New York prices being about ¼c. higher. Second quarter has sold at 9.25c. to 9.50c., St. Louis. Prices show a wide range for the reason that some of the producers will not concede that the market possesses any inherent weakness. They continue to predict higher prices in January, and in view of their comfortably sold-up condition are not inclined to make any concessions at present. The London market for spot was quoted yesterday at £54 5s., as compared with £57 the week previous. The exports this month, including yesterday, are running somewhat lighter than of late. They amounted to 2787 tons.

Antimony.—Asiatic grades are firmly held at 14.25c. to 14.37½c., but there is little or no demand.

Aluminum.—No. 1 virgin aluminum, 98 to 99 per cent pure, is unchanged at 63c. to 65c. per lb.

Old Metals.—The market is quite unsettled, owing to the peace talk. Dealers' selling prices are as follows:

	Cents per lb.
Copper, heavy and crucible	32.50 to 33.00
Copper, heavy and wire	29.00 to 30.50
Copper, light and bottoms	27.00 to 28.00
Brass, heavy	18.00 to 18.50
Brass, light	15.00 to 15.50
Heavy machine composition	25.00 to 26.00
No. 1 yellow rod brass turnings	18.50 to 19.50
No. 1 red brass or composition turnings	21.00 to 23.00
Lead, heavy	7.00
Lead, tea	6.50
Zinc	8.00 to 9.00

Chicago

DEC. 18.—Free offerings of metals by those who desired to sell promptly for the realization of profits had its effect on prices and quotations are generally lower. We quote: Casting copper, 32.50c.; Lake copper, 33.75c. to 35c.; tin, carloads, 43c., and small lots, 45c.; lead, 7.55c. to 7.60c.; spelter, 10.50c.; sheet zinc, 21c.; Cookson's antimony, 50c.; other grades, 17c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 27c.; copper bottoms, 23.50c.; copper clips, 26c.; red brass, 23c.; yellow brass, 17c.; lead pipe, 5.75c.; zinc, 8.50c.; pewter, No. 1, 26c.; tinfoil, 33c.; block tin pipe, 37c.

St. Louis

DEC. 18.—In some of the non-ferrous metals, especially spelter, there has been a weakening of tone and of prices. Quotations to-day, carload lots, were: Lead, 7.50c.; spelter, 10.50c., by sellers. In less than carloads quotations were: Lead, 7.90c.; spelter, 13c.; tin, 47½c.; Lake copper, 35c.; electrolytic copper, 34.50c.; Asiatic antimony, 17c. In the Joplin ore district zinc blende was lower and very weak, but lead ore was stronger. On miscellaneous scrap metals we quote dealers' buying prices as follows: Light brass, \$10.50; heavy yellow brass, 14c.; heavy red brass and light copper, 19c.; heavy copper and copper wire, 22c.; zinc, 7c.; lead, 5.50c.; tea lead, 4c.; tinfoil, 34c.; pewter, 25c.

Germany's New Record in Pig Iron

Germany's pig iron output in October exceeded that for any month since the war started. It was 1,161,005 metric tons, against 1,116,752 tons in September. The largest previous war output was 1,145,292 tons in August, 1916. The daily rate in October also exceeded all war records at 37,452 tons per day, against 37,225 tons in September, the previous record. The October output was made up of 160,055 tons of foundry iron, 16,150 tons of Bessemer iron, 762,115 tons of Thomas iron, 205,840 tons of so-called steel making iron and spiegeleisen and 16,845 tons of forge iron. The total output for the ten months to Nov. 1, 1916, was 11,054,334 tons, against 9,742,917 tons to Nov. 1, 1915.

Advance information gives the October steel output at 1,423,555 metric tons, also a war record.

The Badger Foundry Company, Racine, Wis., has taken the contract for casting the cylinders, valves and other gray-iron parts of a 24-cylinder motor for a hydroplane for Commodore James Pugh, Chicago. The bore of the motor is 6¾ in., and it is expected to develop 2000 b.h.p.

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30.7c.; Birmingham, Ala., 45c. Denver, pipe, 76.1c., minimum carload, 46,000 lb.; structural steel and steel bars, 83.6c.; minimum carload, 36,000 lb. Pacific coast (by rail only), pipe, 65c.; structural steel and steel bars, 75c., minimum carload, 50,000 lb.; structural steel and steel bars, 80c., minimum carload, 40,000 lb. No freight rates are being published via the Panama Canal, as the boats are being used in transatlantic trade.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, $\frac{1}{4}$ in. thick and over, and zees 3 in. and over, 3c. to 3.25c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs.	.10
Angles, 3 in. on one or both legs less than $\frac{1}{4}$ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail).	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles.	.30
Handrail tees	.15
Cutting to lengths, under 3 ft. to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	.55
No charge for cutting to lengths 3 ft. and over.	

Plates.—Tank plates, $\frac{1}{4}$ in. thick, 6 in. up to 100 in. wide, 3.50c. to 5c., base, net cash, 30 days, or $\frac{1}{2}$ of 1 per cent discount in 10 days, carload lots. Extras are:

Quality Extras	Cents per lb.
Tank steel	Base
Pressing steel (not flange steel for boilers)	.10
Boiler and flange steel plates	.15
"A. B. M. A." and ordinary firebox steel plates	.20
Still bottom steel	.30
Locomotive firebox steel	.50
Marine steel, special extras and prices on application.	

Gage Extras	
Rectangular, $\frac{1}{4}$ in. thick, over 6 in. wide to 100 in. wide. Base	
Lighter than $\frac{1}{4}$ in., to 3/16 in., up to 72 in. wide	.10
*Lighter than $\frac{1}{4}$ in., including 3/16 in., over 72 in. to 81	.20
*Lighter than $\frac{1}{4}$ in., including 3/16 in., over 84 in. to 96	.30
*Lighter than $\frac{1}{4}$ in., including 3/16 in., over 96 in. to 100	.40
*Lighter than $\frac{1}{4}$ in., including 3/16 in., over 100 in. to 102	.45
Lighter than 3/16 in., including No. 8, up to 72 in. wide	.15
*Lighter than 3/16 in., including No. 8, over 72 in. to 84	.25
*Lighter than 3/16 in., including No. 8, over 84 in. to 96	.35
Lighter than No. 8, including No. 10, up to 60 in. wide	.30
Lighter than No. 8, including No. 10, over 60 in. to 64	.35
Up to 72 in. and not less than 10.2 lb. per sq. ft. will be considered $\frac{1}{4}$ in.	
Over 72 in. must be ordered $\frac{1}{4}$ in. thick on edge, or not less than 11 lb. per sq. ft. to take base price.	
Over 72 in. wide, ordered less than 11 lb. per sq. ft., down to weight of 3/16 in., take price of 3/16 in.	
Over 72 in., ordered weight 3/16 in., take No. 8 price.	
Over 72 in., ordered weight No. 8, take No. 10 price.	

Width Extras	
Over 100 in. to 110 in. inclusive	.05
Over 110 in. to 115 in. inclusive	.10
Over 115 in. to 120 in. inclusive	.15
Over 120 in. to 125 in. inclusive	.25
Over 125 in. to 130 in. inclusive	.50
Over 130 in.	1.00

Length Extras	
Universal plates 80 ft. long up to 90 ft. long	.05
Universal plates 90 ft. long up to 100 ft. long	.10
Universal plates 100 ft. long up to 110 ft. long	.20

Cutting Extras	
No charge for rectangular plates to lengths 3 ft. and over.	
Lengths under 3 ft. to 2 ft. inclusive	.25
Lengths under 2 ft. to 1 ft. inclusive	.50
Lengths under 1 ft.	1.55
Circles 3 ft. in diameter to 100 in.	.30
Circles over 100 to 110 in. (width extra)	.35
Circles over 110 to 115 in. (width extra)	.40
Circles over 115 to 120 in. (width extra)	.45
Circles over 120 to 125 in. (width extra)	.55
Circles over 125 to 130 in. (width extra)	.80
Circles over 130 in. (width extra)	1.30
Circles under 3 ft. to 2 ft. inclusive	.55
Circles under 2 ft. to 1 ft. inclusive	.80
Circles under 1 ft.	1.85
Half circles take circle extras.	
Sketches not over four straight cuts, inc. straight taper	.10
Sketches having more than four straight cuts	.20
Plates sheared to a radius take complete circle extras.	

*Including extra for width.

Wire Rods.—Including chain rods, \$70 to \$75.

Wire Products.—Prices to jobbers effective Nov. 27: Fence wire Nos. 6 to 9, per 100 lb., terms 60 days or 2 per cent discount in 10 days, carload lots, annealed, \$2.95; galvanized, \$3.65. Galvanized barb wire and

staples, \$3.85; painted, \$3.15. Wire nails, \$3. Galvanized nails, 1 in. and longer, \$2 advance over base price; shorter than 1 in., \$2.50 advance over base price. Cement coated nails, \$2.90. Woven wire fencing, 53 per cent off list for carloads, 52 off for 1000-rod lots, 51 off for less than 1000-rod lots.

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from Dec. 4, 1916, all full weight:

Butt Weld			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
$\frac{1}{4}$, $\frac{3}{8}$ and $\frac{5}{8}$	.59	32 $\frac{1}{2}$	$\frac{1}{4}$ and $\frac{3}{8}$	.48	.21
$\frac{1}{2}$	.63	48 $\frac{1}{2}$	$\frac{3}{8}$	.49	.22
$\frac{3}{4}$ to 3	.66	52 $\frac{1}{2}$	$\frac{1}{2}$	.53	.35
			$\frac{3}{4}$ to 1 $\frac{1}{2}$	.56	.40

Lap Weld			Reamed and Drifted		
Inches	Black	Galv.	Inches	Black	Galv.
2	.59	46 $\frac{1}{2}$	$\frac{1}{4}$	.42	.27
2 $\frac{1}{2}$ to 6	.62	49 $\frac{1}{2}$	$\frac{1}{2}$	.48	.34
7 to 12	.59	45 $\frac{1}{2}$	2	.49	.35
13 and 14	.49 $\frac{1}{2}$		2 $\frac{1}{2}$ to 4	.51	.38
15	.47		4 $\frac{1}{2}$ to 6	.51	.38
			7 to 12	.50	.37

Butt Weld, extra strong, plain ends			Standard Charcoal Iron		
Inches	Black	Galv.	Inches	Black	Galv.
$\frac{1}{4}$, $\frac{3}{8}$ and $\frac{5}{8}$	.55	37 $\frac{1}{2}$	$\frac{1}{4}$, $\frac{3}{8}$ and $\frac{5}{8}$	.48	.31
$\frac{1}{2}$	.60	47 $\frac{1}{2}$	$\frac{3}{8}$	.53	.40
$\frac{3}{4}$ to 1 $\frac{1}{2}$	.64	51 $\frac{1}{2}$	$\frac{3}{4}$ to 1 $\frac{1}{2}$	.57	.42
2 to 3	.65	52 $\frac{1}{2}$			

Lap Weld, extra strong, plain ends			Reamed and Drifted		
Inches	Black	Galv.	Inches	Black	Galv.
2	.57	45 $\frac{1}{2}$	$\frac{1}{4}$	.44	.29
2 $\frac{1}{2}$ to 4	.60	48 $\frac{1}{2}$	$\frac{1}{2}$	.49	.35
4 $\frac{1}{2}$ to 6	.59	47 $\frac{1}{2}$	2	.51	.38
7 to 8	.55	41 $\frac{1}{2}$	2 $\frac{1}{2}$ to 4	.53	.41
9 to 12	.50	36 $\frac{1}{2}$	4 $\frac{1}{2}$ to 6	.52	.40
			7 to 8	.46	.34
			9 to 12	.41	.29

To the large jobbing trade an additional 5 per cent is allowed over the above discounts, which are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black, and three (3) points on galvanized, but in some sections of the country discounts on less than carloads are three (3) points less (higher price) than the carload discount on both black and galvanized steel pipe.

On butt and lap weld sizes of black iron pipe, discounts for less than carload lots to jobbers are four (4) points lower (higher price) than carload lots, and on butt and lap weld galvanized iron pipe are five (5) points lower (higher price).

Boiler Tubes.—Discounts on less than carloads, freight to be added, effective from Nov. 1, 1916, except 3 to 4 $\frac{1}{2}$ in. steel from Nov. 20, are as follows:

Lap Welded Steel		Standard Charcoal Iron	
Inches	Black	Inches	Black
1 $\frac{1}{2}$	.31	1 $\frac{1}{2}$ in.	.23
1 $\frac{1}{4}$ and 2 in.	.43	1 $\frac{1}{4}$ and 2 in.	.35
2 $\frac{1}{4}$ in.	.40	2 $\frac{1}{4}$ in.	.32
2 $\frac{1}{2}$ and 2 $\frac{3}{4}$ in.	.46	2 $\frac{1}{2}$ and 2 $\frac{3}{4}$ in.	.38
3 and 3 $\frac{1}{4}$ in.	.46	3 and 3 $\frac{1}{4}$ in.	.43
3 $\frac{1}{2}$ to 4 $\frac{1}{2}$ in.	.46	3 $\frac{1}{2}$ to 4 $\frac{1}{2}$ in.	.44
5 and 6 in.	.45	5 and 6 in.	.37
7 to 13 in.	.42	7 to 13 in.	.34

Locomotive and steamship special charcoal grades bring higher prices.

1 $\frac{1}{2}$ in. over 18 ft., and not exceeding 22 ft., 10 per cent net extra.

2 in. and larger, over 22 ft., 10 per cent net extra.

Sheets.—Makers' prices for mill shipments on sheets of United States standard gage, in carload and larger lots, are as follows, 30 days net, or 2 per cent discount in 10 days:

Blue Annealed Sheets		Cents per lb.
Nos. 3 to 8	Nos. 9 to 12	Nos. 13 to 16
		.40 to 4.25
		.37.5 to 4.00
		.38.5 to 4.10

No. 17 and lighter gages are based on \$4.50 per 100 lb. for No. 28 Bessemer black sheets.

Box Annealed Sheets, Cold Rolled		
Nos. 17 to 21	Nos. 22 and 24	Nos. 25 and 26
		.4.30 to 4.55
		.4.35 to 4.45
		.4.40 to 4.65
		.4.45 to 4.70
		.4.50 to 4.75
		.4.55 to 4.80
		.4.65 to 4.90

Galvanized Sheets of Black Sheet Gage

Nos. 10 and 11		.5.25 to 5.75
Nos. 12 to 14		.5.35 to 5.85
Nos. 15 and 16		.5.50 to 6.00
Nos. 17 to 21		.5.65 to 6.15
Nos. 22 and 24		.5.80 to 6.30
Nos. 25 and 26		.5.95 to 6.45
No. 27		.6.00 to 6.50
No. 28		.6.25 to 6.75
No. 29		.6.40 to 6.90
No. 30		.6.55 to 7.05

Tin Mill Black Plate

Nos. 15 and 16		.4.05 to 4.20

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Utilizing Waste Heat to Generate Steam*

Advances Made in Recent Years—Savings Possible with Open-Hearth Steel Furnaces—Suggestions on Explosion Prevention

BY ARTHUR D. PRATT†

THE utilization of waste heat from various industrial processes for the generation of steam is not new. The advance within the last few years, however, in methods of utilizing such gases and in the results secured from their utilization has been so remarkable as to make of interest a comparison of former with present-day methods and results.

The design of waste-heat boilers has progressed to a point where it is to-day possible to generate steam successfully from gases whose temperatures are as low as 950 to 1000 deg. Fahr. It is but a few years since it was considered absolutely impracticable from a commercial standpoint to attempt to produce power from such gases, and it is in its ability to utilize these gases satisfactorily that the development of the modern waste-heat boiler has its most far-reaching effect.

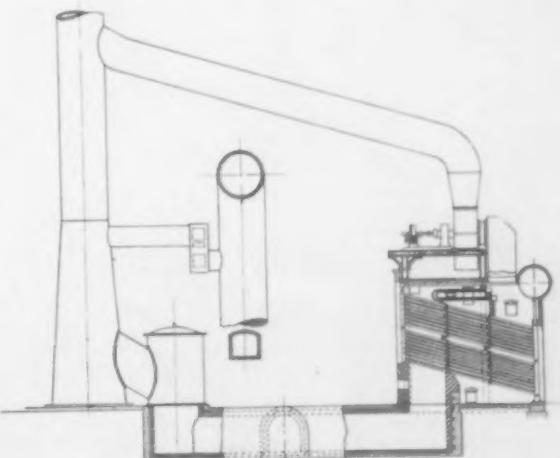
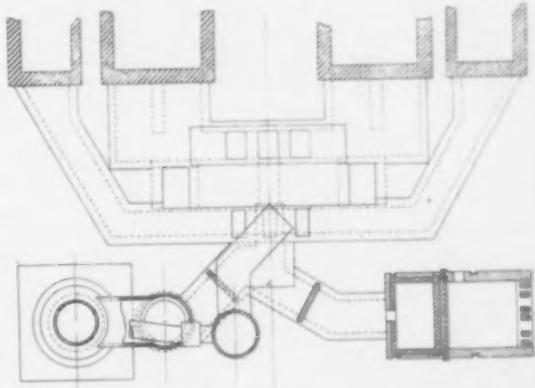
The sole theory on which early waste-heat boiler installations were made has as its basis the non-interferences in the operation of the primary furnace. This resulted in the installation of a given amount of heating surface arranged in such manner that the frictional resistance to the gases in their passage through the boiler should be a minimum. As a result of minimizing this draft loss, such boilers as were installed were ordinarily entirely without baffles and the gases were given a straight passage through the boiler, though partially baffled boilers were used occasionally. High exit-gas temperatures were considered rather desirable than otherwise to assist the stack in giving the required drafts. Boilers installed in this way were considered practicable only with gases whose temperatures approached those of coal-fired practice. The users accepted the steam generated as "something for nothing" and no particular endeavor was apparently made toward increased capacities.

Present-day waste-heat practice has come about with a more thorough understanding of the laws governing heat transfer and an appreciation of the function of gas velocity as affecting transfer rates. It may be broadly stated that the rate of heat transfer is dependent upon gas velocity and temperature difference between the gas and the absorbing surface. Experiments have shown that at even the highest velocities now used in waste-heat work the effect of increased temperature difference is small as compared with that of increased gas velocity.

In coal-fired boiler practice, the average temperature difference between gases and boiler surfaces is approximately 1150 deg. The heat-transfer rate corresponding to a boiler's rated capacity is about 3 B.t.u. per hr. per sq. ft. of surface per degree difference, or a heat absorption of 3450 B.t.u. per sq. ft. of surface per hr. In waste-heat work the temperature difference varies widely with the class of waste heat. With a gas temperature of, say, 1250 deg. entering a boiler, the average temperature difference between boiler surface and gas for a working pressure of 170 lb. per sq. in. will be about 500 deg. For such a temperature difference the transfer rate to give an absorption per square foot of surface equal to that of the coal-fired boiler at rating would have to be 6.9 B.t.u. per hr. per sq. ft. per degree difference. This rate is slightly higher than the rates corresponding to velocities that are as yet ordinarily used, but, with somewhat higher entering-gas temperatures, the absorption per square foot of surface is such as to enable a boiler's rated capacity to be developed without difficulty. With gas temperatures entering the boiler

of 1800 to 2000 deg., which approach coal-fired practice, high overloads are being developed.

The gas velocity necessary to give what is now considered a desirable transfer rate lead to a frictional resistance through waste-heat boilers which makes the use of a natural-draft stack impracticable. Let us consider what is probably the extreme case insofar as draft conditions are concerned, namely, the open-hearth steel furnace. Common practice in this class of work is to use stacks 160 ft high, which give a draft as their base of approximately 1.4 to 1.6 in., depending upon the gas temperatures. For the present purpose, assume that the draft loss through a modern waste-heat boiler installed with an open-hearth furnace is 2.0 in., a figure which approximately represents the practice of to-day. With a natural-draft stack the



Plan View and Sectional Elevation of a Waste-Heat Boiler Applied to an Open-Hearth Steel Furnace

draft at the checkers corresponding to the 1.4 to 1.6 in. given above is approximately 1.3 to 1.5 in., and this amount is necessary for the proper operation of the furnace. With a waste-heat boiler installed, then the draft necessary at the exit of the boiler must be sufficient to overcome the resistance through the boiler, 2 in.; that necessary to overcome resistance through the flues, say 0.75 in., and 1.5 in. necessary at the checkers, or a total of 4.25 in. It is to be remembered that with a waste-heat boiler installed, the temperature of the gases entering the stack, instead of being 1000 or 1200 deg., will be 450 or 500 deg., under which conditions a stack of 160 ft. instead of giving a draft of 1.4 to 1.6 in. at its base would give approximately

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0.9 in., and to give the necessary 4.25 in. the stack height would have to be somewhat over 700 ft.

While this is perhaps the extreme case, the same reasoning applies in practically all waste-heat work, and an induced-draft unit is now almost universally used with the modern design of waste-heat boiler. In certain classes of waste-heat work, such a fan not only furnishes the required draft suction, but is of a decided advantage in the operation of the primary furnace.

As may be inferred, the successful utilization of waste gases becomes more difficult with decreasing gas temperatures. It was in connection with regenerative furnaces and low-temperature gases that the principles of high gas velocity were first applied and the modern waste-heat boiler was developed. The success of the early installations in this particular class of work led to the application of this theory to all classes of waste-heat practice. Waste-heat boilers of the modern design are in successful operation today with copper refining furnaces, cement kilns, open-hearth steel furnaces, beehive coke ovens, zinc refining furnaces and heating furnaces of various types, both regenerative and non-regenerative. The waste-heat boiler of to-day was developed with low-temperature gases, and its largest field, until the present, has been with open-hearth steel furnaces.

This particular phase of waste-heat work may be considered new. In the open-hearth steel furnace we have the best and by far the most numerous examples of the regenerative furnace. From the very nature of the operation of such furnaces, gas temperatures passing to the stack are low, and the ability of the modern waste-heat boiler to utilize successfully these gases for

heating surfaces. The second installation, made at the Gary plant of the Indiana Steel Company, consisted of 28 special six-drum Rust boilers equipped as in the case of the Stirling boilers with special cross baffles. The third installation described is that made at the Pencoyd works of the American Bridge Company and consists of a cross-drum Babcock & Wilcox boiler, the width of boiler and the tube length being such as to give the gas-passage areas necessary for the required gas velocity. For low-temperature waste-heat work, the type of boiler of which this installation is an example is in general best suited.

Table 1 gives the results secured from the Stirling and Rust boilers described and from Babcock & Wilcox boilers similar in design to that installed at Pencoyd, though set with considerably larger open-hearth furnaces. That the three installations described by Bacon are truly progressive, at least from the aspect of heat absorption, may be seen from the results given in this table. Tests 1, 2 and 3 are as given in Bacon's paper and its discussion. Test 4 is included as being of interest in indicating the results that may be secured with gases at a temperature considerably below that ordinarily found in open-hearth work. At this particular plant, the gas temperatures leaving the checkers were not appreciably lower than in other tilting furnaces, but the necessary flue arrangement was such that there was an excessive radiation loss between the checkers and the boiler from flues and reversing valves.

In Table 1, the proper basis for the comparison of results is the rate of heat transfer, but in order that such a comparison may be intelligent, it is necessary in connection with the transfer rates to give proper

Table 1—Results of Tests of Waste-Heat Boilers for Open-Hearth Furnaces

Test No.	1†	2	3	4
Plant and location.	Illinois Steel Company, South Chicago, Ill.	Indiana Steel Company, Gary, Ind.	Bethlehem Steel Company, South Bethlehem, Pa.	Lackawanna Steel Company, Buffalo, N. Y.
Rated capacity of furnace, tons.	65	75	80.0	...
Actual production, tons.	72‡	85	82.6	...
Boiler.	Stirling	Rust	B. & W.	B. & W.
Heating surface, sq. ft.	4,000	4,880	5,232	5,407
Superheat, deg. Fahr.	128	176	121	97
Gas weight, lb. per hr.	73,000	83,434	75,271	78,947
Gas per hr. per sq. ft. of heating surface, lb.	18.3	17.1	14.4	14.6
Temperature of gas entering boiler, deg. Fahr.	1,227	1,155	1,362	986
Temperature of gas leaving boiler, deg. Fahr.	621	530	493	468
Drop, deg. Fahr.	606	625	869	518
Draft at boiler inlet, in.	...	1.47	1.55	1.76
Draft at boiler damper, in.	...	3.95	3.29	3.63
Draft loss, in.	1.78	2.48	1.74	1.87
Gross power developed, hp.	334.5	393.0	425.8	306.0
Per cent of rated capacity**.	83.6	80.6	81.4	56.7
Boiler horsepower to fan.	...	60||	24.3§	...
Net horsepower.	...	386.0	401.5	...
Approximate transfer rate.	5.08	6.92	4.77	5.12

†Average of 10 tests.

‡ Approximate.

§ Motor-driven fan.

||53 hp. returned in feed-water heater.

|| Tilting furnace.

**All ratings are on the basis of 10 sq. ft. per hp.

the generation of steam is, without question, the best proof of the progress in the development of this particular class of boiler.

An experimental waste-heat boiler for this work, embodying the principles but possibly not the design of the modern waste-heat boiler, was installed at the South Chicago plant of the Illinois Steel Company, in 1910. The results from this installation, while by no means comparable with those secured to-day with the more highly developed design, so clearly indicated possible savings in the practically untried field of open-hearth practice that two boilers, the design of which may be considered well past the experimental stage, were purchased for this same plant in 1911.

C. J. Bacon, steam engineer of the Illinois Steel Company, presented before the American Iron and Steel Institute in May, 1915, a paper,* "Waste Heat Boilers for Open-Hearth Furnaces," in which he describes the experimental boiler referred to, and traces the development in this class of work through the first three installations made. The first of these, at the plant of the Illinois Steel Company, in South Chicago, consisted of two Stirling boilers equipped with special cross baffles to give the desired gas velocities over the

consideration to the gas weights per square foot of heating surface, entering and exit gas temperatures, and the percentage of rated capacity developed. To give a direct comparison of the performance of two different boilers, the gas weight per square foot of heating surface and the entering-gas temperature should be the same. It is possible from our present knowledge of the laws of heat transfer to compute with surprising accuracy the results that may be expected from any boiler for a given set of conditions. Let us consider, then, the results which the boiler of Test No. 4 would give under the gas conditions of Test No. 1. For a weight of gas per square foot of surface corresponding to Test No. 1, the total weight of Test No. 4 would become 98,950 lb. per hr. With this weight passing through the boiler of Test No. 4, at the temperature actually existing in No. 4, the boiler would develop approximately 363 hp., or 67 per cent of its rated capacity. With an entering temperature equal to that in Test No. 1, the boiler would develop approximately 500 hp., or 92 per cent of its rated capacity. These figures are included simply to show the importance of giving all factors proper consideration where a comparison of results is to be made.

In connection with waste-heat boilers there are certain features of installation and operation, some of

*This paper was printed, substantially in full, in THE IRON AGE, June 17, 1915.

which refer specifically to open-hearth work and others to waste-heat work in general, that are of interest.

LOCATION OF BOILERS AND CONNECTING FLUES

The early boiler installations were made with open-hearth furnaces already in operation. With these furnaces it was necessary to connect the boiler to the flue between the reversing valves and the stack, the boiler thus being on a branch flue while the stack was on the more direct connection. It was, and is, common practice, in laying out open-hearth furnaces, to place the stack central with the furnace, and wherever such an arrangement is followed the boiler would of necessity be on the branch flue. It is recommended, and to-day this recommendation is being more or less followed, that the boiler be placed central with the furnace and the by-pass stack on the branch connection. Such an arrangement will give a straight gas passage to the boiler, minimizing frictional resistance in the connecting flues due to the absence of turns, and will have a tendency to give an equal distribution of the gases across the width of the boiler. A further advantage of such an arrangement is that better protection is given to the by-pass stack damper. These dampers are ordinarily of cast iron, and where they close a direct passage to the stack, they are subjected to temperatures considerably higher than if the stack were on the branch connection and this damper installed on such connection.

The flues from the reversing valves to the boiler should be as short as possible to minimize radiation losses. The location of such flues, with the same object in view, is also of importance. Ordinarily these are placed underground, and their depth beneath the surface should be such as to furnish a sufficiently thick insulating layer of earth on top. The best practice is to make this layer from 3 to 4 ft. thick. In one installation where, because of certain unavoidable conditions, the thickness of the earth covering on the top of the flue was something less than 1 ft., the temperature of the surface of this earth was over 400 deg. The loss from radiation from such a flue is obvious.

Ample means should be supplied for keeping these connecting flues clean, and the area should be such as to allow a certain amount of accumulation of dust when the furnace is down without impeding the draft. The average life of an open-hearth furnace is probably around 300 heats, though occasionally 350 are obtained. When the amount of dust carried in the gases is considered, it is readily conceivable how there can be an accumulation between furnace lay-off periods that will seriously affect the draft. In one instance where, because of press of work, the connecting flue was not cleaned out during two periods when the furnace was down, the dust filled the flue to more than a third of its cross-sectional area.

AIR LEAKAGE

Too much importance cannot be attached to keeping flue connections and boiler settings tight, to minimize air leakage, the effect of which is to reduce gas temperatures, decrease boiler capacity and place an added burden on the fan unit.

The effects of air leakage and the possible improvement in results through its reduction may be shown by an example: One of the early boilers installed was with a small furnace which had been in operation for some time. The boiler was first put into service with no particular attention given to the tightness of existing flues, and a continuous run of 119 hr. was started. For the first day or two, the gas temperatures entering the boiler were very low, the temperature drop between the checkers and the boiler entrance being some 650 deg. This excessive cooling of the gases was found to be due to air infiltration through the length of the flue and an excessive amount of leakage at the stack by-pass valve. Nothing could be done toward remedying the latter defect, while the furnace was in operation, but flue leaks were stopped as far as possible without stopping the test. The reduction in these leaks increased the gas temperatures entering the boiler at the end of the run to approximately 1000 deg., as

against 600 to 650 deg. at the start. The average gas temperature entering the boiler during this run was 855 deg.

The furnace was then shut down, the sources of air leakage more thoroughly gone over, and the leaky dampers repaired and sealed. A second run of 120 hr. was then started, during which the average gas temperature entering the boiler, with the furnace conditions as nearly as possible like those in the first run, was 1153 deg. The loss between checkers and boiler was reduced to approximately 300 deg., most of which was due to a faulty reversing valve that could not be repaired without replacing.

The results of the two runs, showing the effect of reducing leakage, are as follows:

Run No.	1	2
Gas entering boiler | CO ₂	8.08	10.49
O	11.46	8.29
Gas temperature entering boiler, deg. Fahr.	855	1153
Gas temperature leaving boiler, deg. Fahr.	426	479
Draft boiler damper, in.	3.99	3.77
Draft boiler inlet, in.	1.85	1.85
Draft drop, in.	2.14	1.92
Steam to fan engine, b.h.p.	35.70	28.10
Power developed, hp.	132.40	200.20
Per cent of rated capacity	53.80	81.40

It is of interest to note from these figures that by minimizing the air leakage the draft loss through the boiler was reduced 0.22 in., which made possible a lower fan speed with a considerably higher economical rate for the fan turbine. A saving was effected of 7.5 b.h.p. for the fan drive, and there was an increase of 67 gross hp. Although this may be an extreme case, the enormous gains secured by reducing the air leakage to a minimum are obvious.

Air leakage through the flues can be minimized through proper design and location. Leakage through the boiler setting is reduced by the use of a compact design, well erected and bricked in, with precautions to prevent leakage about all cleaning and dusting door frames. Much can be done by painting the settings with asphaltum paint.

CLEANING

The waste gases from open-hearth furnaces are very dirty; and because of the low temperatures, it is, perhaps, of more importance in this class of work than in coal-fired practice that the heating surfaces be kept clean. In the early installations, fears were expressed that dirt would have a tendency to stick to the tubes and be difficult, if not impossible, to remove. Experience has shown, however, that ordinary methods of dusting give perfectly satisfactory results.

In practically all plants now operating waste-heat boilers in connection with open-hearth furnaces, the boilers are dusted once in 24 hr. In one plant which operates 11 such boilers and in which the results are checked perhaps more closely than in the average steel plant, the engineers have concluded as the result of actual experience that it pays to dust every 8-hr. shift.

Some figures showing the effect of dusting on exit-gas temperatures are of interest. In a certain plant a series of tests were run with cleaning intervals of 20, 10 and 6 hr. When the boiler was allowed to go 20 hr. without cleaning, the reduction in gas temperatures after cleaning was 60 deg.; where the cleaning intervals were 10 hr., 50 deg., and where 6-hr. intervals elapsed, the reduction varied from 10 to 30 deg. In a second plant, with larger boilers, after an undusted period of 24 hr., for an unchanged entering temperature the exit temperature was reduced 35 deg. by a thorough cleaning. In this instance, with the gas weight passing through the boiler, this 35-deg. reduction was equivalent to an increase of 22 hp. This increase in capacity would not, of course, hold over a period of 24 hr., but it would appear conservative to state that the 24-hr. cleanings for such conditions would correspond to at least a net saving of 10 hp. as against 48-hr. cleanings. At \$40 a year per hp.—a rough estimate of the yearly value—this would mean an annual saving of \$400 per boiler.

The draft loss through a clean boiler will be less than through one not dusted; and while the decrease in load on the fan due to cleaning may not be great, it will at least be appreciable.

Customary practice has been to use a vertical cast-iron sliding damper for the stack by-pass. Considerable difficulty has been experienced in keeping such dampers tight, and where the stack connection, rather than that to the boiler, is the direct connection, difficulty through warping has sometimes occurred. While as far as is known it has never been tried, it would appear that a damper similar in design to reversing valves warranted a trial, to reduce leakage at this point. Such a damper would automatically close the passage to the stack when that to the boiler was open, and vice versa, at the same time stopping all air leakage at a point where this might be excessive. It is possible that such a design of by-pass damper would require a small amount of cooling water, but the loss in heat to this water would, it is believed, be more than offset by the gain through reduced air leakage.

EXPLOSIONS

In the operation of open-hearth furnaces certain characteristic explosions are liable to occur during the reversal of gas valves. These vary in intensity from slight puffs to rather heavy explosions and are caused by a mixture of fresh air with carbon monoxide which must pass off during the operation of reversal. Such explosions, often unnoticed with furnaces directly connected to a stack, become very evident where boilers are installed and every effort is made to keep flues and settings tight. It was feared, and rightly, that with the installation of waste-heat boilers the heavier explosions might have a destructive effect on the boiler settings and connecting flues. For this reason particular attention should be given to proper buckstay construction, and an ample number of explosion doors should be furnished to relieve the pressure within the setting, should explosions take place.

A thorough investigation of the trouble from explosions showed that by a proper system of reversing-valve operation the difficulty would be practically overcome; certainly to an extent where sufficient and properly designed explosion doors would obviate the possibility of wrecking or injuring the settings.

The essential feature in such operation is to avoid opening the stack valves from gas and air checkers simultaneously, or nearly enough together to allow the hot producer gas and air from the checkers to mingle and ignite within the flues or boiler settings. In this system of reversal the air stack valve is opened a sufficient interval after the opening of the gas stack valve to allow the gas pocketed in the checkers to pass away and mingle with the existing gases before the hot air from the other set of checkers is admitted to the flues through opening the air stack valve. In reversing the operation, similar precautions should be taken respecting the corresponding gas and air stack valves.

In a plant where this system was followed, explosions were reduced from approximately 40 per day (about one each two reversals), varying in intensity, to 4 in 411 consecutive reversals covering a period of five days, and of these 4 but 2 could be called heavy and were directly traceable to a leak in a hydraulic valve, which through the operation of the ram, caused the gas valve to unseat.

Another system used is one of interconnected valves, sets of valves being operated simultaneously. Perhaps the best method would be a combination of the two; that is, valves interconnected to assist in manipulation but so arranged that the first order will be followed. The connections should be designed so that sufficient time will elapse between opening the stack valves and gas and air valves to make impossible the mingling of hot producer gas and air.

SAVINGS

Great savings have been made possible by the installation of waste-heat boilers with open-hearth furnaces, and some approximate figures are of interest. There have been installed, or ordered, over 90,000 rated b.h.p. for this class of waste-heat work alone. These boilers are set with over 190 open-hearth furnaces, the annual total production of which is considerably in excess of 9,200,000 tons of steel. Experience has shown that through the use of waste-

heat boilers the net cost of production of this material is reduced from 20c. to 25c. per ton, which would mean a net annual saving for the production weight given above of \$1,840,000, using the lower figure.

From another aspect: A conservative estimate of the power delivered by the boilers in this class of work through a year's operation would be 60 per cent of their rated capacity, or 54,000 hp. The value of a boiler horsepower in a steel mill varies widely with any number of factors, and ranges from \$35 to \$50 per year. On the basis of the lower figure, which is certainly conservative, the value of the 54,000 hp. produced would represent a saving of \$1,890,000.

Waste-heat boilers, because of their special design, are more expensive than coal-fired boilers, and the expense is increased by the cost of fans, connecting flues and structural material. The latter expense is the greatest where boilers are installed with existing furnaces. Regardless of this increased cost the return on the investment is such as beyond question to warrant the expenditure. Mr. Bacon, in the paper to which reference has been made, states that this return on the investment is 60 per cent or over, and recent experience would seem to indicate that this figure is conservative.

In the early days of this work, open-hearth steel furnace operators were fearful that the installation of waste-heat boilers with their fan units would seriously affect the operation of the furnace and that the production would be cut down, the cause of such reduction being in the necessity of longer heats. By actual experience just the contrary was found to be true, and furnaces equipped with boilers showed a decrease in time of heats. In one instance, a 35-ton furnace equipped with a waste-heat boiler and fan was set in a line with five other furnaces not so equipped. The operation of all furnaces was alike and the size of the heats the same. Over a period of six days the average time of heat for the furnace equipped with the waste-heat boiler was 9.17 hr., while the average for the other five furnaces was 11.17 hr. Eight different sets of furnaces in all were investigated in connection with the saving in heat length. These furnaces varied in rated capacity from 35 to 75 tons, the actual production ranging from 40 to 87 tons per heat. The normal length of heat in the furnaces connected direct to the stack, from records secured previous to the installation of the waste-heat boilers, averaged, for the eight furnaces, 12.1 hr. The average length of heat for the same furnaces, after the installation of the waste-heat boilers, was 10.8 hr., the saving in time varying in individual furnaces from but a few minutes to 2.9 hr. The total tonnage per heat of the eight furnaces in question was 507 tons. The increased tonnage of the eight furnaces due to the decrease in heat length would amount to 42,000 tons per year, or approximately a 12 per cent increase in the total tonnage of these furnaces.

There is a further saving due to the use of the induced-draft fan with which these waste-heat boilers are equipped. This is in the increased life of the furnace and results from the fact that a fan makes it possible to run economically a heat from a furnace which under ordinary natural-draft conditions would take so long that it would not pay.

Russian Women Replacing Technical Men

Because of the increase in munitions plants in Russia, considerable difficulty is being experienced in securing a sufficient number of trained technical men to direct them. The French *L'Echo des Mines* states that an imperial Russian decree has been issued by which all female students who have attended the Polytechnic Institute at Petrograd are authorized to take examinations for the degree of engineer and that 47 women have already been accepted.

The world's tin-smelting capacity is placed at 137,600 tons, according to the *Mining World*. Asia is credited with 89,000 tons, England with 28,000 tons, Germany with 11,200 tons, the United States with 11,200 and Australia with 3400 tons.

PERSONAL

Arthur H. Young, for some years supervisor of labor and safety of the Illinois Steel Company, Chicago, will take up his new duties as director of the American Museum of Safety, New York, on Jan. 1. He began his business career at the age of 13 as a messenger boy for the Illinois Steel Company. He became successively leverman, assistant in chemical laboratory, timekeeper, pay-roll clerk, statistician and assistant supervisor of labor and safety, the last covering oversight over accident prevention, personal injury settlements, employment, fire, police, plant cleanliness, sanitation, plant restaurants, visiting nurses and other welfare matters, including pensions. In addition to this, the duties involved the administration of discipline and

review of all cases of discharge by superintendents and foremen, complaints of improper working conditions or equipment, with full power to make any necessary adjustments.

J. E. Johnson, Jr., 52 William Street, New York, sails from Vancouver Dec. 28 on the Empress of Asia for Shanghai, China, on professional business. He will return in the latter part of April.

Eli Webb, formerly superintendent of the Pittsburgh Crucible Steel Company's blast-furnace department, Midland, Pa., who resigned to accept the position of general superintendent of the Virginia Iron, Coal & Coke Company's blast furnaces, entered upon his new duties Dec. 15, with headquarters at Roanoke, Va.

The Youngstown Chemists' Club, Youngstown, Ohio, has been organized with the following officers: President, Edwin G. Pierce, consulting chemist; secretary, Carl W. Weesner, Carnegie Steel Company; treasurer, H. E. Moyer, Brier Hill Steel Company. Housing plans presented at the first regular meeting, Dec. 14, met with much enthusiasm.

Thomas W. Moran, president Moran Flexible Steam Joint Company, Louisville, Ky., is recovering from an operation to correct an internal disorder. He had been seriously ill for several weeks.

C. Brown, formerly of Worcester, Mass., on Jan. 1 will succeed M. A. Williamson as manager of the Southern office of the Norton Company, Worcester, Mass., located at Chattanooga, Tenn. Mr. Williamson resigned to become business manager of the *Journal of Industrial and Engineering Chemistry*, Easton, Pa.

A. E. Adams, president of the First National and Dollar Savings banks, Youngstown, has been elected a director of the Ohio Iron & Steel Company, succeeding Samuel Mather, resigned.

Edward T. Corbus, production manager of the Union Drawn Steel Company, Beaver Falls, Pa., has resigned, effective Jan. 1. After that date he will be connected with the Columbia Steel & Shafting Company, Carnegie, Pennsylvania.

The Anderson Forge & Machine Company, Detroit, Mich., has elected the following officers: R. A. Alger, president; F. M. Alger, vice-president; F. A. Hinchman, secretary and treasurer; C. E. Wade, general manager; H. S. Beebe, sales manager; J. F. White, purchasing agent.



W. Y. Shaw, Skinner Engine Company, Philadelphia, was scheduled to deliver an illustrated talk on the universal unaflow engine before the Engineers' Club of Trenton, N. J., on the evening of Dec. 21.

In response to a special request from the Russian-American Chamber of Commerce in Moscow, asking the American-Russian Chamber of Commerce in New York to send a special delegate to Russia to confer in regard to a number of important matters relative to Russian-American trade, E. C. Porter, executive secretary of the American-Russian Chamber of Commerce, will sail for Russia early in January and will remain in that country for two months, visiting the important industrial centers, including Petrograd, Moscow, Kieff, Charkoff, Odessa, and Tiflis.

S. B. Taylor, sales manager of the S K F Ball Bearing Company, Hartford, Conn., has been made vice-president, succeeding F. B. Kirkbride, who remains on the board of directors. Mr. Taylor will continue in charge of sales. G. A. Ungar, former representative of the company in Cleveland, Detroit and Pittsburgh, has been appointed technical manager and chief engineer, succeeding Uno Forsberg, who returns to Sweden, having completed his work of creating the American manufacturing organization.

C. A. McMasters, treasurer of the Alaska Steamship Company, Seattle, has resigned to become president and managing director of the Washington Shipbuilding Company, Tacoma, recently incorporated. He is one of the organizers of the company and will have active charge of building the plant.

Henry Maerz, formerly with the Hamilton Machine Tool Company, Hamilton, Ohio, has resigned to accept a position in the sales department of the Cullen Machinery Company, Cleveland, Ohio.

C. W. Cullen, of the C. W. Cullen Machinery Company, Cincinnati, Ohio, announces the merger of his company with the E. S. Cullen Machinery Company, Cleveland. The new company will be operated under the name of the Cullen Machinery Company, with headquarters in Cleveland, but a branch office will probably be established in Cincinnati at an early date.

Herbert H. Halliday, formerly assistant cashier, secretary and treasurer of the Citizens Trust & Savings Bank, Columbus, Ohio, has resigned to accept a position with the Ironsides Company, Columbus, dealer and manufacturer of factory supplies and lubricating oils.

J. O. Smith has been appointed sales manager of the Hampden Corundum Wheel Company, Springfield, Mass. For more than the past ten years he was in the employ of the American Emery Wheel Works, Providence, R. I.

A. S. Blagden has been elected president of the American Malleables Company, which has offices at 30 Church Street, New York, and works at Bloomfield, N. J., and Lancaster, N. Y. He succeeds W. G. Pearce, who was elected chairman of the board.

James A. Constantine has been elected president and general manager of the Colonial Foundry & Machine Company, Columbia, Pa., recently organized. J. E. Baker has been elected vice-president, and George Sheuberger, secretary and treasurer.

F. O. Stallman, formerly manager of the Pacific Tool & Supply Company, San Francisco, has opened a new store at 129 First Street, San Francisco, under the name of the F. O. Stallman Supply Company, carrying a line of high grade machine tools, shop supplies, and garage equipment.

A. J. Boal has been promoted from superintendent of the machine shop to general superintendent of the Hoopes & Townsend Company, Philadelphia. He has been with this company for several years, and was formerly with the Midvale Steel Company and the Enterprise Manufacturing Company in positions of importance.

W. A. Linn has been appointed purchasing agent of the Chicago, Milwaukee & St. Paul Railway Company, Chicago, succeeding John T. Crocker, retired, effective Jan. 1.

Pittsburgh and Nearby Districts

The car problem at Youngstown has become so serious that a leading official of the Baltimore & Ohio Railroad has been sent there to straighten out the tangle and secure a better movement. Not only is the output of pig iron, semi-finished steel and finished steel being seriously restricted, but when material is ready for shipment it is impossible for producers to get cars in which to load it. The chief trouble is said to be lack of motive power, but there is also a serious shortage of cars.

The Youngstown Foundry & Machine Company, Youngstown, has received a contract for all the finishing housings, bed plates, etc., for the 8-in. hoop mills, 8-in. bar mills and 10-in. bar mills for the new mills to be built by the Carnegie Steel Company at McDonald, near Youngstown. It had previously received the contract for the pinion housings. Orders have also been booked for one 34-in. inclosed type headstock roll lathe for the Youngstown Sheet & Tube Company, for another for the New Castle works of the Carnegie Steel Company, and for three large shears for the Mansfield Sheet & Tin Plate Company, Mansfield, Ohio.

The Ladel Mfg. Company, New Philadelphia, Ohio, which recently took over the business of the Spicer Mfg. Company, will erect a new foundry and machine shop. It will be in the market shortly for a complete equipment for these buildings, including one or two 15-ton traveling cranes. The company will build a general line of foundry and machine work, and will also manufacture industrial trucks. Fred F. Hall is president; Ivor Harris, vice-president; E. C. Browne, secretary and treasurer, and U. D. Miller, works manager.

The regular monthly meeting of the Association of Iron and Steel Electrical Engineers of Pittsburgh was held in the Fort Pitt Hotel in that city on Saturday evening, Dec. 16, preceded by a dinner. The meeting was under the direction of the standardization committee, of which F. D. Egan is chairman. The January meeting will be held in the same hotel on Saturday evening, Jan. 20. Papers on direct current and alternating current automatic skip and bell hoists will be presented by H. D. James, Westinghouse Electric & Mfg. Company; Frank Smith, Otis Elevator Company; R. H. McLain, General Electric Company, and F. J. Burd, Cutler-Hammer Mfg. Company.

In addition to the purchase of about 1200 acres of the Josiah V. Thompson coal lands by the H. C. Frick Coke Company, it has bought between 200 and 300 acres formerly operated by the Dilworth Coal Company, located in Greene County, Pa.

The General Fireproofing Company, Youngstown, will issue \$194,700 of new preferred and \$250,000 of new common stock for the purpose of making plant extensions.

The Johnstown Fuel Company, Johnstown, Pa., has notified manufacturing consumers that after Jan. 1 it will discontinue supplying natural gas to manufacturers because of a shortage in the supply.

The December meeting of the Pittsburgh Foundrymen's Association, which took the form of a Christmas celebration, was held in the Fort Pitt Hotel, Pittsburgh, on Monday evening, Dec. 18. W. W. Sanderson, Pittsburgh representative of the Carborundum Company, Niagara Falls, N. Y., was chairman of the entertainment committee, and vaudeville and other forms of entertainment were provided.

The Sharon Foundry Company, Sharon, Pa., is increasing its capital stock from \$250,000 to \$460,000.

The city of Erie, Pa., has awarded a contract for waterworks improvements as follows: Twenty million-gal. low-service pumping engine and 600 tons of cast-iron pipe and fittings to R. D. Wood & Co., Camden, N. J.; 24-in. Venturi meter to the Simplex Valve & Meter Company, Philadelphia, Pa.; and gate valves to the Eddy Valve Company, Waterford, N. Y.

The report that the Jones & Laughlin Steel Company will shortly complete the building of a new rod mill at its Aliquippa works is untrue. It has no new

construction work under erection at present, having completed recently its new tube mills. These comprise two butt and two lap weld furnaces, one of each now being in operation.

The general offices of the Memphis Steel Construction Company, whose plant is at Greensburg, Pa., have been removed to the Magee Building, Pittsburgh. The company specializes in steel-plate construction.

OBITUARY

E. P. BORDEN, vice-president, secretary and treasurer, Pulaski Iron Company, Pulaski, Va., and Philadelphia, died suddenly Dec. 15 at his home in Philadelphia, aged 81 years. He had been associated with the company since its organization about 28 years ago. He was a New Englander by birth and heavily interested in textile enterprises. He was a member of the Union League and Manufacturers' Club of Philadelphia, and of the New England Society. He leaves one son, E. Shirley Borden.

WILLIAM J. HOWARD, for 45 years associated with the Illinois Steel Company and its predecessors at Milwaukee, and for 10 years chief auditor at the Bay View plant, died Dec. 14, aged 71 years. He was a native of England and went to Milwaukee in 1871, taking the position of purchasing agent of the old Milwaukee Iron Company.

Argentina's Iron and Steel Imports

Argentina's imports of iron and steel in the first half of 1916 have fallen off decidedly from those before the war, as the following table shows. Metric tons are used:

	1914	1915	1916
Pig iron	74,930	9,254	16,104
Wrought iron	36,952	19,659	3,907
Galvanized sheets	29,483	25,439	8,314
Steel ingots	4,873	3,079	1,031
Steel rails	69,008	3,970	1,512
Tin plates	4,420	6,593	7,595
Plain galvanized wire	18,730	6,597	10,048
Barb galvanized wire	4,489	4,547	3,525
Wire, not galvanized	13,407	6,479	9,167
Girders, joists, etc.	17,790	2,074	236

The pig-iron imports are less than one-fourth of what they were before the war and the steel rails less than 2½ per cent.

Some Interesting Government Contracts

The contract for furnishing 85,500 1-pounder anti-aircraft projectiles, bids for which were opened Nov. 29 by the chief of the bureau of ordnance, Navy Department, Washington, has been awarded to the Worthington Pump & Machinery Company, New York.

The Armored Motor Car Company, Detroit, has been awarded the contract for furnishing the Bureau of Ordnance, War Department, with two armored automobiles under bids opened Nov. 24, at \$5,300 each.

The contract for furnishing a locomotive crane for Pearl Harbor, Hawaii, has been awarded to Victor R. Browning & Co., Cleveland, at \$94,852.

A supervising mining engineer and metallurgist is desired by the Bureau of Mines for field service at a salary of \$4,000 a year. By an act of Congress mining experiment stations have been created to study and improve local conditions in mineral industries and a supervisor is required to direct one of these stations. The Civil Service Commission, Washington, D. C., announces that competitors will not be required to report for examination, but that they must submit complete data on their education and experience and a thesis or some report or publication by Jan. 16, 1917. Special application form 2118 may be obtained from the commission or from the civil service boards in large cities. Applicants must be graduates of mining engineering or metallurgy and have had at least five years of responsible experience, two of which were in metallurgical lines.

Railroad Car Business

Close to 10,000 cars have been put under contract, counting 3000 for Russia, divided between the American Car & Foundry Company and the Standard Steel Car Company. There is a possibility that these represent cars which it was thought three or four months ago were placed with the Bettendorf Company. Deliveries in April are named.

Other awards include 1000 box and 500 automobile cars for the Northern Pacific, ordered of the Western Steel Car & Foundry Company; 1000 general service cars for the Los Angeles & Salt Lake, placed with the Pressed Steel Car Company; 1200 hopper cars for the New York Central, bought of the American Car & Foundry Company; 750 gondolas for the Nickel Plate, to be built by the Pressed Steel Car Company; 500 cars for the Clark Car Company, awarded to the Cambria Steel Company, and 1500 cars for an Eastern road divided between two companies. The Great Northern is to build 500 stock cars in its own shops and the American Car & Foundry has closed lately on about 1000 tank cars.

The Atlantic Coast Line is inquiring for some 20 passenger equipment cars and it is understood that the Erie has bought 50 wooden express cars.

The Superior Steel Company, Carnegie, Pa., manufacturer of hot and cold rolled strip steel, has been purchased by a group of Eastern bankers, who announce a reorganization of the company. The bankers interested are Cassatt & Co. and Frazier & Co., Philadelphia; Merrill, Lynch & Co. and White, Weld & Co., New York. The new company will have a capitalization of \$11,500,000, of which \$3,500,000 will be in 8 per cent cumulative convertible first preferred stock, \$2,000,000 in 8 per cent cumulative convertible second preferred stock and \$6,000,000 in common stock. The plant is stated to have a capacity of 115,000 tons a year.

The corporation of S. Cheney & Son, Manlius, N. Y., is passing its fiftieth successive year in business, which was started by Stephen Cheney in 1866, and the third generation is now connected with it. The company celebrates its fiftieth anniversary by starting a branch foundry at Oneida, N. Y., where it has excellent shipping facilities on the New York Central and New York, Ontario & Western. This new plant is completely equipped, having electric cranes, molding machines, exhaust mills and other modern appliances, besides automatic sprinklers. It is located on a plot covering eight acres, thus providing ample room for expansion.

Fire, said to have been of incendiary origin, as it followed an explosion, virtually destroyed the plant of the Llewellyn Iron Works, Los Angeles, Cal., Dec. 16, causing a loss of several hundred thousand dollars. This is the plant which was partly wrecked by an explosion on Christmas Eve, 1910, caused by a bomb planted by Ortie McManigal, confessed dynamiter, who destroyed also the *Times* newspaper establishment. The recent fire came a few hours after David Caplan, charged with murder in connection with the *Times* dynamiting six years ago, had been convicted of voluntary manslaughter.

The Reeves Pulley Company, Columbus, Ind., received a cable from an importer at Tokio, Japan, asking for a quotation on a variable-speed transmission for a paper mill. The price was cabled back and an acceptance received with orders for immediate shipment. It was all done in 48 hours.

French iron and steel imports for the first eight months of 1916 were 1,100,000 tons, against 31,600 tons in the same period in 1914. Of this year's total the United States sent 600,000 tons, against only 1100 tons to September 1, 1914.

NEW BETHLEHEM PURCHASES

Lebanon Valley Blast Furnaces and American Iron & Steel Mfg. Company Included

Besides acquiring the property of the American Iron & Steel Mfg. Company, as noted in these columns on Dec. 7, the Bethlehem Steel Company has also taken over five blast furnaces, and further control of the Cornwall Ore Banks and also the Cornwall Railroad, represented by the ownership of and leases held by the Lackawanna Iron & Steel Company, Lebanon, Pa. The negotiations are about concluded, and it is expected that the Bethlehem Steel Company will take title as of Jan. 1.

The blast furnaces include the two Colebrook furnaces owned by the Lackawanna Iron & Steel Company and rated at 130,000 tons of pig iron annually, and the two Bird Coleman, and the one North Cornwall furnace, all three at Cornwall, Pa., with a combined capacity of 115,000 tons, which were held under lease by the Lackawanna company. At the Colebrook furnaces are 232 Otto-Hoffmann by-product coke ovens and a benzol plant.

The ore acquisition means that in addition to holding a majority control of the Cornwall Ore Banks through the purchase of the Pennsylvania Steel Company, the Bethlehem Steel Company will now have substantially complete control, as the Lackawanna Iron & Steel Company had a one-sixth interest in the ore property outright, with an additional voting interest of about one-sixth. The Cornwall Railroad, which goes with the sale, is 13 miles long and owns 172 cars.

According to an announcement by James Lord, president American Iron & Steel Mfg. Company, the price paid for the latter company was \$6,556,800. As the capital stock was made up of \$3,000,000 in preferred shares and \$2,550,000 in common stock, it appears that the price averages about \$59 per share of a par value of \$50. As noted in the issue of Dec. 7, the American Iron & Steel Mfg. Company, with plants at Lebanon and Reading, Pa., has an annual capacity of 170,000 tons of bar iron and steel.

New Boiler with By-Product Recovery

A new type of boiler, with the object of eliminating the smoke nuisance and saving by-products from coal, has been designed by George Wilkinson, borough electrical engineer of Harrogate, England. The patent claims are:

The coal is distilled, yielding tar and ammoniacal liquor. The coke obtained gravitates while incandescent into the furnace, being consumed there without smoke.

The gas, after removal of by-products, is passed into the furnace under considerable pressure with the necessary air; it burns with a smokeless flame until it enters the retort flue, where it is transformed into radiant heat, absorbed partly by the retort and partly by the water of the boiler. Active steaming surfaces are produced not only in the furnace but on the whole flue surface.

The inventor expects to get from 20 to 25 lb. evaporation per square foot of heating surface. The boiler is automatically fed with coal which passes automatically through the various stages of distillation and combustion.

A safety code for hoisting chains developed by Earl B. Morgan, safety engineer, Norton Company, Worcester, Mass., has been published by the National Safety Council, Commercial and Continental Bank Building, Chicago, and a copy can undoubtedly be had on application. It is known as No. 344 of the service series issued by the Council.

Austria-Hungary's total steel output in 1916, it is estimated, will reach 3,350,000 tons, as compared with 2,690,000 tons in 1915, 2,190,000 tons in 1914 and 2,790,000 tons in 1913. The production of all kinds of iron and steel this year is expected to exceed that of any previous year.

Machinery Markets and News of the Works

NO HOLIDAY LULL SO FAR

Demand Unaffected by Talk of Peace

Scattered Purchasing of Miscellaneous Machine Tools Holding Up Well Everywhere—Rising Cost of Castings May Advance Prices

There is every indication, as was the case last year, that the midwinter holiday lull will be of short duration. Some very good orders were placed on the eve of Christmas, a year ago, and it is not improbable that similar Christmas presents may be given this year. Business is holding up in a satisfactory manner everywhere, and appears to have suffered no ill effects from the talk of peace, which is probably accounted for by the fact that the existing demand comes almost entirely from industrial sources.

The Cleveland market is fairly active, with a scattering demand absorbing the attention of the trade, although one inquiry from a new company which is to manufacture wheels for automobile trucks calls for machine tools worth about \$50,000.

Domestic business continues to lead in Cincinnati, although export buying is by no means absent. It is pointed out in Cincinnati that the higher cost of castings will compel some makers of heavy machinery to advance their prices. Some central Ohio manufacturing plants have been compelled to curtail operations recently because of their gas supply being shut off by the cold weather.

In Chicago, the small-lot buying is unabated, and the number of new plants and extensions is notable.

Some big buying has been done in Detroit by the Harroun Motors Company for its new plant at Wayne, Mich. There is a feeling in Detroit that the city may become the aeroplane center of the country. Several companies which manufacture, or intend to manufacture, aircraft are planning to locate in Detroit.

Business in Milwaukee holds up in a way that precludes the shortening of deliveries.

The shipyards in the Pacific Northwest have been active buyers in the West as well as in the East.

The New York market continues active, with the buying pleasing because of its diversity. A recent inquiry called for 700 screw machines for export to England.

New York

NEW YORK, Dec. 20, 1916.

The demand in this territory continues extremely good, and is notable because of its diversity, both as regards the tools wanted and the various industries from which the inquiries come. Practically no orders have been coming from munitions plants for some time. Purchasing is largely confined to one or two tools by each buyer, but it is a healthy kind of business and very satisfactory to sellers.

The inquiry for 700 No. 4 screw machines, to which reference was made in the issue of Dec. 7, was issued by the Singer Mfg. Company, Elizabethport, N. J., for export to England. It is understood that the company merely undertook to obtain bids and deliveries on certain machines and cable the information to London, where the Ministry of Munitions was to pass on the propositions submitted.

The Hamilton & Chambers Company, 29 Broadway, New York, engineer for the shipbuilding plant which the United

States Steamship Company, C. W. Morse, president, is to build on the Thames River, New London, Conn., is making the necessary surveys and laying out shop plans.

The Loew-Victor Engine Company, Chicago, Ill., maker of marine engines, has decided to move to Newark, N. J., where it will acquire or build a plant, and is preparing a list of the equipment which will be required. The company is said to be contemplating the manufacture of automobile engines as well.

The Aeromarine Plane & Motor Company, Nutley, N. J., has recently purchased a few machine tools and expects to move into a new plant soon.

The Eastern railroads are by no means as active as the Western lines in the acquisition of new shop equipment. They are buying an occasional machine for replacements, but in several cases they have yet to act on inquiries they issued months ago for tools whose prices have been advanced repeatedly. The New York, New Haven & Hartford has recently bought some roundhouse equipment.

The export demand for machines seems to have entered quite largely into the hands of a few of the larger companies who are best equipped to handle such business and who, in preparation for it, have stock orders placed with the tool builders. Russia is buying principally for delivery next spring and summer.

Egleston Bros. & Co., 166 South Street, New York, are in the market for a gate shear to cut $\frac{1}{2}$ -in. plates 12 ft. long and 60 in. wide.

The Mutual Electric Company, 122 Water Street, New York, is in the market for power presses from 5000 to 20,000 lb. in weight, and also for planing machines, shaping machines and lathes.

The Habirshaw Electric Cable Company, 10 East Forty-third Street, New York, has let contract for the construction of a two and three-story addition to its manufacturing plant at Yonkers, N. Y., 200 x 300 ft.

The Bridgeman Smith Company, 487 Kent Avenue, Brooklyn, N. Y., manufacturer of paper boxes, has acquired 12 acres in the Kingsland section, Lyndhurst, N. J., for the erection of a plant, to which it proposes to remove its present factory.

The Duryea Mfg. Company, Jersey City, N. J., manufacturer of belting, has awarded contract for a new factory on Avenue C, Bayonne, to cost \$91,900, to James Mitchell, Inc., contractor, 76 Montgomery Street, Jersey City.

Robert A. Van Voorhis, Jersey City, N. J., and associates, have incorporated in Delaware the Hammond-White Mfg. Company with a capital stock of \$1,000,000 to manufacture sound-recording machines. Cornelius A. Cole, Hackensack, N. J., and Arthur R. Oakley, Pearl River, N. Y., are also active in the company.

The American Concrete-Steel Company, Essex Building, Newark, N. J., has been awarded contract by the Harrison Mfg. Company, Lockport, N. Y., maker of automobile radiators, for the construction of a reinforced concrete manufacturing building, 170 x 400 ft., two stories and basement, which is to be completed April 15. James R. Tyler, Rochester, N. Y., is the architect.

The Lehigh Valley Railroad took title recently to a tract of land extending 3600 ft. along New York Bay on the New Jersey side, with extensive rights to land under water just north of the Pennsylvania Railroad's freight yards at Greenville, N. J. The property was acquired as a site for the freight terminal which, it is reported, the railroad expects to build at this point at a cost estimated at \$10,000,000.

John Campbell & Co., Newark, N. J., manufacturers of bookbinders' materials, will build a new pigment plant, 18 x 86 ft., on Plum Point Lane.

C. H. Reiman & Co., Inc., Newark, N. J., have been incorporated with a capital stock of \$50,000 to manufacture wire punches, tools, etc. Henry Audley, White Plains, N. Y.; Walter B. Hall, Brooklyn, N. Y., and John A. Larkin, New York City, are the incorporators.

The Charles Burroughs Company, Commerce Street, Newark, N. J., manufacturer of hydraulic pumps and presses, will make alterations in its plant to cost about \$18,000. E. M. Waldron, Inc., 207 Market Street, Newark, is the contractor.

Phonographs, Ltd., Newark, N. J., has been incorporated with a capital of \$100,000 to manufacture talking machines. William A. Hardy, Frederick Bachmann and Jacob Unger are the incorporators.

The Aluminum Goods Mfg. Company, 699 Springfield Avenue, Newark, N. J., is having bids taken through its architect, E. F. Ficken, Oliver Building, Pittsburgh, Pa., for the construction of a five-story factory, 60 x 300 ft., on Belmont Avenue, Newark.

The Merrick-Scale Mfg. Company, 225 Main Street, Passaic, N. J., has let contract for the erection of a one-story shop, 75 x 85 ft.

The Bausch & Lomb Optical Company, Rochester, N. Y., wants to purchase new lathes for delivery at its plant not later than Jan. 10 next. It is in the market for five 14-in. x 6-ft. or 8-ft. cone-driven engine lathes, S. B. G., Hendy or LeBlond type preferred.

The Transmission Ball Bearing Company, Buffalo, has let contract to the J. C. Cowper Company, Fidelity Building, Buffalo, for the construction of a one-story manufacturing plant on Military Road. It will be 20 x 100 ft. C. M. Murray, Toronto, Ont., is general manager.

The Elmira Foundry Company, Elmira, N. Y., has let contract for the construction of a one-story foundry, 50 x 160 ft., to cost about \$25,000.

The Thomas Aeromotor Company, Ithaca, N. Y., in readjusting certain internal matters has dissolved itself and reincorporated with a capital stock of \$67,000. Jerome A. Fried is general manager.

The McCord Mfg. Company, Millbrook, N. Y., has been incorporated with a capital stock of \$1,375,000 to do a contracting manufacturing business, including the production of automobiles, accessories, etc. The incorporators are F. D. Stoba, 25 Corbin Avenue; A. J. Gathercole, 165 Wilkinson Avenue, Jersey City, and E. A. Gingras, Cross Street, Englewood, N. J.

The Geneva Furnace Company, Geneva, N. Y., has filed articles of incorporation with a capital stock of \$200,000 to manufacture stoves, ranges, furnaces, hardware, etc.; E. H. Palmer, L. G. Hoskins and M. E. Sheridan are the incorporators.

Pass & Seymour, Solvay, N. Y., manufacturers of electrical fittings, will build a factory 60 x 200 ft., three stories and basement, from plans of Russell & King, architects, Syracuse. J. W. Brooks is manager.

The Commercial Electrolytic Company, 105 Liberty Street, New York, has let contract for a boiler house and coal-storage building at its new Buffalo plant at Colgate Avenue and the South Buffalo Railroad.

The Equipment Mfg. & Foundry Corporation, Buffalo, has filed incorporation papers with a capital stock of \$150,000 to manufacture foundry equipment, castings, etc. R. Linton, Brisbane Building, is manager. Charles J. Staples, 1040 Ellicott Square Building, Buffalo, is the company's attorney.

New England

BOSTON, MASS., Dec. 18, 1916.

The Providence Engineering Works, Providence, R. I., has been sold to the Providence Engineering Corporation, just incorporated with capital stock of \$500,000 by William E. Hussey, William B. Dukeshire and Edgar H. Mead, all of Brooklyn, N. Y. The new owners are now or have been connected with the Standard Shipbuilding Corporation and the incorporation papers permit the company to carry on a general shipbuilding business. No attempt will be made for the present to carry on this branch of the business, but the plant will continue to turn out the engines formerly made there and will build a new line of marine engines and nautical appliances.

The American Electric Welding Company, Boston, Mass., has been incorporated with capital stock of \$15,000. The directors are George Vetter, East Boston, president and treasurer; A. M. Doering and C. E. Thomann.

The L. P. Brown Machine & Tool Company, Attleboro, Mass., has been incorporated with capital stock of \$20,000. Lester P. Brown, president; Josiah A. Martin, Mansfield, treasurer; and George M. Faulkner are the directors.

The Colt Patent Fire Arms Mfg. Company, Hartford, Conn., has voted to ask permission to increase its capital stock. The present capital stock is \$2,500,000 and it is reported that the new authorized capital will be \$10,000,000; but the further issues will be authorized in amounts as needed to care for the growth of the business.

The Mohawk Iron & Metal Company, North Adams, Mass., has been incorporated with capital stock of \$10,000. The directors are William G. Todd, president; Alice C. Smith, 35 Congress Street, Boston, treasurer; and J. M. Bullard.

The Foster, Merriam Company, Meriden, Conn., has increased its capital stock from \$240,000 to \$320,000.

The Chase Metal Works, Waterbury, Conn., has begun work on an addition, 60 x 100 and 20 x 140 ft., one story.

The Quality Saw & Tool Works, Springfield, Mass., has awarded a contract for an addition, 50 x 100 ft., one story.

The Electric Cable Company, Bridgeport, Conn., has awarded a contract for an addition, 57 x 130 ft., four stories.

The Bridgeport Iron & Metal Company, Bridgeport, Conn., has been incorporated by William Olderman, Ansonia; P. Nowitz, Bridgeport, and Aaron Olderman, Ansonia.

George Muench, Stamford, Conn., has awarded a contract for a machine shop, 38 x 65 ft., one story.

Landers, Frary & Clark, New Britain, Conn., are receiving estimates for an addition, 30 x 178 ft., four stories, to the Humanson & Beckley plant. They have also awarded the contract for a new factory building, 38 x 238 ft., two stories, to be located on Elm Street.

The directors of the Lake Torpedo Boat Company, Bridgeport, Conn., have authorized the erection of a third large addition to the machine shop, a large storehouse for naval supplies and several smaller structures. Substantial additions will also be made to the docks.

The Locomobile Company of America, Bridgeport, Conn., is expected to award soon a contract for an addition, 100 x 160 ft., one story, and of a roof, 30 x 600 ft., over a space between two of the present buildings.

The General Electric Company, according to press reports, has voted authorization for three new buildings at its Pittsfield, Mass., plant and has appropriated \$100,000 for the first of them. The old plant of the Triumph Voting Machine Company in the same city has been deeded to the General Electric Company and is to be used for manufacturing purposes.

The Stanley Works, New Britain, Conn., is to build an addition 60 x 160 ft.

The capital stock of the Taylor Machinery Company, 8 Oliver Street, Boston, Mass., recently incorporated, is \$13,000, not \$3,000 as stated in THE IRON AGE of Dec. 7.

Philadelphia

PHILADELPHIA, PA., Dec. 18, 1916.

Trenton manufacturers, hampered by freight congestion, plan, it is said, a concerted movement to prevent the closing of the Delaware and Raritan Canal, Dec. 20. An appeal will be made to the Pennsylvania Railroad, lessee, to keep it in operation this winter, except when the ice becomes too thick.

The Trenton plant of the American Bridge Company, which recently added a steel barge-building department has already launched four barges and has two others on the ways. It has orders for additional barges which will tax this department to its full capacity until 1918.

The Lehigh Coal & Navigation Company has spent so far approximately \$75,000 on improvements at the Cranberry mines at Hazleton, Pa., which were acquired from A. Pardee & Co. last July. It is stated that the operations are to be completely electrified by 1920, but they will probably be finished much before that time.

The blacksmith shop and foundry of the William Cramp & Sons Ship & Engine Building Company, Philadelphia, were damaged by fire, Dec. 13, with an estimated loss of \$25,000.

The Ross-Tacony Crucible Company, Philadelphia, will build a three-story brick plant, 70 x 100 ft., at Robbins and Milnor streets, to cost \$33,900.

The E. Wahl Mfg. Company, Philadelphia, manufacturer of bone goods, will make alterations to its factory at 3970 Pulaski Avenue to cost about \$4,600.

The J. E. Lonergan Company, 211 Race Street, Philadelphia, brass founder, has awarded a contract for a new two-story reinforced concrete building, 45 x 100 ft., at Second and Florist streets to the William Steele & Sons Company, 16 Arch Street, Philadelphia.

The Penn Metal Ceiling & Roofing Company, Philadelphia, has awarded a contract for the erection of an addition to its plant at Twenty-fifth and Wharton streets to cost \$5,500.

R. D. Wood & Co., Philadelphia, manufacturers of machinery, will increase the capacity of their steel casting plant at Florence, N. J., to handle work for the Bethlehem Steel Company.

George Sahsenmaier, 930 North Third Street, Philadelphia, will make alterations to his machine shop, to cost about \$8,000.

The L. H. Gilmer Company, Philadelphia, manufacturer of belting, has awarded a contract for the erection of a two-story plant, 50 x 160 ft., at Keystone Street, Tacony, to the Nickson-Duggan Construction Company.

The addition being constructed by the Lifter Ice Cream Company, Philadelphia, will be used as a garage, not as a machine shop, as has been stated.

The Modern Aeros Corporation, Ltd., Broad Street Bank Building, Trenton, N. J., recently incorporated with a capital of \$100,000, has acquired property on the Miller and Margerum tract near Pennington Avenue, and will immediately

commence the erection of a plant for the manufacture of aeroplanes. Armand W. Allyn is secretary and general manager.

The Utah Potash Company, Trenton, N. J., has acquired property near Ingham Avenue, and has commenced the erection of a plant, 40 x 180 ft., to cost \$20,000. The structure will be equipped with machinery for the reduction of ores to be shipped from the company's mines at Marysville, Utah.

The Positive Lock Bolt Company, Camden, N. J., has been incorporated with a capital stock of \$100,000 to manufacture bolts, nuts, spindles, etc. Charles A. Cogan, Camden; Charles Metrus, W. M. Leslie, and Samuel Friedenburg, Philadelphia, are the incorporators.

The Penn Counties Truck Company, Allentown, Pa., has acquired the former De Journo Soap Company property along the Central Railroad of New Jersey, as a site for a plant for the manufacture of motor trucks. The main factory will be 90 x 475 ft. The plant will have a capacity of about 2000 trucks from $\frac{1}{2}$ to 2 tons capacity. Martin E. Kern is vice-president.

The Macungie Brass Mfg. Company, Macungie, Pa., is planning to enlarge its foundry to specialize in iron castings.

The Hale Motor Car Company, Wayne, Pa., has awarded a contract to John D. Lengel, Wayne, for a one and two-story addition to its plant.

The Mauch Chunk Iron Works, Mauch Chunk, Pa., is planning for the installation of new machinery.

The Lancaster Steel Products Company, Lancaster, Pa., is having plans prepared for a new addition to its plant to provide for an increased capacity.

The Slaymaker Lock Mfg. Company, Lancaster, Pa., manufacturer of padlocks, has had plans prepared for an addition, 35 x 165 ft., to enable it to rearrange its tool and press departments now too crowded by continual additions to its machine-tool equipment.

The Landis Tool Company, Waynesboro, Pa., has voted to increase the capital stock from \$1,000,000 to \$2,000,000 to provide for business extensions.

The Abrasive Material Company, Bridesburg, Philadelphia, has awarded contract to John R. Wiggins & Co., 1215 Filbert Street, Philadelphia, for a three-story addition to its plant, 82 x 86 ft., to cost about \$40,000.

In connection with its taking over of the Slatington Rolling Mills, the recently incorporated Slatington Iron & Steel Company, Slatington, Pa., has increased its capital stock from \$10,000 to \$100,000. No additions to the plant are contemplated. B. Frank Conner is general manager.

The report that the McCullough Iron Company, foot of Seventh Street, Wilmington, Del., had been sold to the Wilson Steamship Company is untrue. Capt. Wilson, however, has bought some stock in the iron company, which is continuing its operations as before. Vice-president Bush has recently resigned and his office is now vacant.

The Baldwin Locomotive Works, Philadelphia, is taking bids for the construction of four bays, each 50 ft. wide and 145 ft., 240 ft., 295 ft. and 310 ft. long each, to be added to its foundry building at Eddystone, Pa.

Catalogs Wanted

The Lebanon Gear & Machine Company, Lebanon, Pa., has taken over the plant formerly occupied by the Lebanon Foundry & Machine Company at Lebanon, and has it partly equipped with machine tools and in operation. The company contemplates installing additional machine tools, including gear cutters, with the intention of operating the plant as a jobbing and specialty shop, and for the production of cut and cast gears. It has at present some machine tools in operation turning out disk-type steel automobile wheels and plans shortly to produce a new type of tool holder and expanding mandrill. Catalogs from manufacturers would be appreciated. H. T. Gerdes, treasurer of Gerdes & Co., Inc., contracting engineer, 30 Church Street, New York, is also treasurer of the new company.

Baltimore

BALTIMORE, MD., Dec. 18, 1916.

Plans are being made to establish the Commercial Ship & Hydroaeroplane Company of America in this city with \$300,000 capital stock to manufacture a new hydroaeroplane. J. Frank Fox, attorney, 211 Law Building, is in charge of the plans. William Barcus, 1717 West Fayette Street, is active in the company.

Rogers & Abels, automobile repairers, 421-423 North Front Street, Baltimore, have leased a building at 815-817 Hillen Street, which it will equip as a machine shop. Work will be started immediately.

The Commonwealth Light & Power Company, Baltimore, recently incorporated for \$11,000,000 by John C. Jackson and Roger Sherman, 30 Pine Street, New York City, and George

R. Gaither, 111 North Charles Street, Baltimore, has increased its capitalization to \$15,000,000.

The Visible Non-Refilling Bottle Stopper Company, 232 Courtland Street, Baltimore, recently incorporated by Caleb R. Kelly, William N. Garthe, and others, is considering the establishment of a plant at Decatur and Nicholson streets.

The Artillery Fuse Company, Wilmington, Del., will build a plant addition to cost \$3,500.

Plans are being made by the Newport News Shipbuilding & Drydock Company, Newport News, Va., for the construction of new buildings next year.

The main building which will be constructed by the Baltimore Enamel & Novelty Company, Woodall Street, Baltimore, will be 250 x 450 ft., and cost about \$200,000. It will be located at Westport, Md.

The Southern Steel Construction Company, 207 Hoffman Building, Baltimore, has leased a lot, 75 x 300 ft., at Thirtieth Street and York Road and plans are being made to establish a steel fabricating plant.

Chicago

CHICAGO, ILL., Dec. 18, 1916.

The pressure of general buying of machine tools in small lots is unabated and machinery dealers without exception report inability to accumulate representative stocks because of the steady demand. The number of plant additions and new enterprises continues to run very high. This new construction is creating a demand for power equipment in relative proportions. An illustrative inquiry is that of the William D. Gibson Company, Chicago, for a 150-hp. internal combustion engine and a number of japanning and tempering furnaces. The Chicago, Burlington & Quincy has issued its supplemental list of machinery required for new shops, mention of which was made last week.

The Sherwin-Williams Company has plans for a three-story brick factory at 542-4 Kensington Avenue, Chicago, at a cost of \$25,000.

The Appleby Hinge Mfg. Company, Chicago, has been organized with a capital of \$2,500, by William K. Appleby, Daniel S. Gillespie and William A. Jennings, 69 West Washington Street.

The Acme Steel Goods Company, 2834 Archer Avenue, Chicago, is taking figures on an addition to its factory, 94 x 99 ft., to cost \$15,000.

The Aldon Company, manufacturer of railroad supplies, 53a Jackson Boulevard, Chicago, will build a one-story factory building, 50 x 110 ft., to cost approximately \$10,000. Bids are being received by R. G. Pierce, architect, 10 South LaSalle Street.

R. Lavin & Sons, metals, 715 West Fourteenth Street, Chicago, will build a one-story foundry, 50 x 150 ft., at East Chicago, at a cost of \$15,000.

H. Nelson, 569 West Van Buren Street, Chicago, is building a two-story machine shop, 52 x 125 ft., the cost to approximate \$25,000.

The Inland Pump Mfg. Company, Chicago, has been incorporated with a capital of \$2,500 by Fred M. Clarke, 105 North Clark Street, T. Frank Quilly and George L. Hippie.

The Industrial Mfg. Company, Jackson and Clinton streets, Chicago, will build a one-story brick factory at 408 Sacramento Boulevard to cost \$10,000.

Eugene Gusler, 1055 West Forty-seventh Street, Chicago, will build a two-story brick factory at 4709 Aberdeen Street to cost \$6,500.

The Chicago Malleable Castings Company, Chicago, will erect a two-story brick factory at 1219 West 120th Street, Chicago, at a cost of \$15,000. A. C. Coffin is the architect.

The Rockford Tool Company, Rockford, Ill., has increased its capital stock from \$50,000 to \$100,000.

E. R. Klemm, 1439 West Austin Avenue, Chicago, Ill., is erecting a two-story service station for motor trucks, 32 x 132 ft., to be added to his present plant. The second story will be devoted to manufacturing purposes and drill presses and other small machinery will be installed. The present plant is equipped with heavy lathes and finishing machinery.

The Standard Spiral Pipe Works, Chicago, is in the market for a motor-driven or steam-driven hammer with capacity for forging $\frac{3}{4}$ -in. material of 32-in. outside diameter. A. J. Berger is vice-president.

The Kansas City Structural Steel Company, 1012 Baltimore Avenue, Kansas City, Mo., is making additions to its plant to cost about \$35,000 in buildings and \$15,000 in equipment, which latter has already been purchased. H. A. Fitch is president. The company is employing about 400 workmen at present.

The 4-S Safety Razor Company, Hutchison, Kan., has let

contract for the erection of a one-story factory building to cost about \$30,000, on a site of 5 acres recently acquired.

The Fountain Faucet Company, Torrey Building, Duluth, Minn., would like to get in touch with porcelain manufacturers and will want motor-driven foundry equipment in addition to its other needs recently mentioned.

The Jackson Compressor Company, 1130 Twelfth Street, Denver, Col., plans the erection of a new plant at Alameda and Cherokee streets, consisting of the following structures: A two-story building, 65 x 256 ft., the ground floor of which will be used for heavy machine tools, such as boring mills, planers, planer type milling machine and slotting machines; a building 30 x 122 ft., containing coal storage, boiler room, engine room, pattern shop and pattern storage; a building 30 x 120 ft., for a forge and drop forge shop, and a two-story building, 65 x 256 ft., for metal-turning machines, including lathes, vertical turret lathes, medium-sized cylinder boring machines and screw machines. The entire plant will be built of cement, brick and steel and will be served by siding from the Santa Fe Railroad. Two 25-ton cranes will be installed in the larger buildings. The power plant equipment has been purchased. It is planned to complete the power building and heavy machine shop by March 15 next, and operate them in connection with the present plant at Twelfth Street. The company is purchasing machine tools worth about \$80,000 and about doubling its present investment in equipment.

The Weston Mfg. Company, Oshkosh, Iowa, L. W. McOmber, general manager, will soon be in the market for lathes and drill presses.

The Hikawa Iron Company, Duluth, Minn., has been incorporated with a capital of \$200,000 by Thomas A. Walker, W. A. and W. P. Hicken, Alexander Hamfeld and Frank Crassweller.

Milwaukee

MILWAUKEE, WIS., Dec. 18, 1916.

Bookings by Milwaukee machine-tool builders continue to be at a volume that gives little hope of shortening the period of deliveries. Metal-working shops which are preparing for extensions and additions next year have been placing orders now to protect their requirements 6 to 8 months hence. The high pressure on shop equipment the past year is making replacements necessary in greater volume than ever before and from this results a steady flow of orders for single tools. Large-lot buying still is conspicuous by its absence.

The Filer & Stowell Company, Milwaukee, sustained a loss estimated at from \$350,000 to \$400,000, Dec. 15, when its four-story pattern shop, drafting room, office and carpenter shop was destroyed by fire. Much of the damage is due to the loss of valuable patterns. The building was 70 x 150 ft. and was erected in 1893. At this time no plans for reconstruction have been made; but it is considered likely that work will be undertaken without delay. Thomas J. Neacy is general manager.

The Stegeman Motor Car Company, 606 Linus Street, Milwaukee, has enlarged its plans for extending its motor truck manufacturing facilities. The size of the new assembly shop has been increased to 150 x 240 ft., and a new administration building, 65 x 65 ft., will be erected. The assembly shop will be reinforced concrete, one-story, with sawtooth roof. The equipment will include three one-story Pawling & Harnischfeger cranes. The present assembly shop will be released to the manufacturing department and will be equipped with new tools, now being contracted for. The list includes a boring mill, boring bar, milling machine, radial drilling machine, grinding machines, etc. The company will make its own rear axles and transmissions. The additions will be completed about March 1 and will make it possible to increase the capacity to from 800 to 900 worm-drive trucks, of 1½ to 7-ton capacities per year. Its business in 1916 was double that of 1915. Oscar Stegeman is president.

The Aluminum Goods Mfg. Company, Manitowoc, Wis., is reported contemplating the establishment of a rolling mill in connection with its main works in Manitowoc, to serve also the plant in Two Rivers, Wis. A third plant is located at Newark, N. J. The project is under consideration, but details are not available at this time. George Vitz is president.

The La Crosse Tractor Company, organized recently at La Crosse, Wis., with a capital stock of \$1,150,000, is completing the consolidation of the Happy Farmer Tractor Company, Minneapolis, with the Sta-Rite Engine Company, La Crosse. The new company will occupy the Sta-Rite plant, which will be more than doubled in size in the coming 6 months. B. F. Hamey, Minneapolis, is general manager.

John Gilson and J. E. Gilson, Port Washington, Wis., have purchased the South Side Foundry Company of that city and have assumed control. A general gray iron foundry and machine shop business will be conducted. John Gilson is the founder of the Gilson Mfg. Company, Port Washington,

with which concern J. E. Gilson also was associated. The Gilson Company passed into the ownership of Harry W. Bolens and Olaf Elton early this year, the Gilsons retiring.

The Industrial Controller Company, 886 Greenbush Street, Milwaukee, now has work well under way on the addition of a second story on its one-story shop, 60 x 125 ft.

The Burlington Brass Works, Burlington, Wis., has resumed operations in its foundry department closed for 19 days for overhauling. The casting shop is working on overtime schedules.

The Vaughn Mfg. Company, maker of harrows, drills, seeders, etc., has arranged for a small production of light motor trucks using the Ford chassis as a nucleus.

The Stika Iron Works, Algoma, Wis., will establish a foundry in connection with its machine shop. The complete equipment has been purchased.

Armour & Co., 62 Second Street, Milwaukee, have awarded contract for the erection of a private garage and service shop, 50 x 100 ft., three stories and basement, to cost \$30,000 to the Raulf Company, 53 Patton Building. T. C. Graves is manager.

Stanley F. Kadow, 988 Kinnickinnic Avenue, Milwaukee, will prepare plans for a brass foundry, to be located on the south side. Owner's name withheld. It will be 40 x 80 ft., one-story and basement, of brick and steel. The project will mature in February.

Hartford, Wis., capital has taken an option on the gray-iron foundry at Beaver Dam, Wis., established about six years ago, and operated by the promoters for only a short time. It is planned to close the deal so that operations may be resumed Jan. 2.

E. H. Manning, La Crosse, Wis., is preparing to establish a factory for the production of wind motors, the first models which will be manufactured under contract with the Dodge Mfg. Company, Mishawaka, Ind.

The Marshfield Air-oator Company, Marshfield, Wis., has been organized by Michael Duval of Lincoln, Wis., to manufacture milk coolers and aerators of his design. A factory is now being equipped.

The Ajax Rubber Company, Trenton, N. J., has purchased the Racine Rubber Company, Racine, Wis., and proposes to make extensions of the facilities next year. Plans have not yet assumed definite shape. Stuart Webster is president of the Racine Company.

The plant of the Fred M. Prescott Steam Pump Company, Greenfield and Sixtieth avenues, West Allis, Milwaukee, comprising a machine shop and foundry, is being offered for sale by Nathanael Greene, Camp Building, Milwaukee. It has not been operated since the company was absorbed by the International Steam Pump Company, now the Worthington Pump & Machinery Corporation, operations being transferred to the branch works at Cudahy, near Milwaukee.

The factory erected at Sauk City, Wis., for the Shaw Motor Company, Chicago, but never occupied, has been leased by Earl McFarland and John Westmont, Lodi, Wis., for the manufacture of steel tractors. Some new equipment will be required.

The Hamilton Mfg. Company, Two Rivers, Wis., has purchased the Fritz Mfg. Company, Grand Rapids, Mich., manufacturing drafting-room fixtures. The machinery is being moved to Two Rivers and operations will be consolidated.

Detroit

DETROIT, MICH., Dec. 18, 1916.

Machine-tool men who have been anticipating the usual falling off in trade in December have been agreeably surprised that the market has remained strong. The expected advance in prices has begun, but manufacturers continue to buy, although the orders are generally small, the single exception being the Harroun Motor Company, which has ordered considerably more machinery for its new plant at Wayne, Mich. Local jobbers are expecting a new market for their machines, as they believe Detroit will shortly become the aeroplane manufacturing center of the country. Companies for the manufacture of aeroplane motors and equipment are planning to organize and locate in this city, and it is expected that several of the large motor companies here will add an aeroplane motor department to their plants. Deliveries on standard machines are still from 3 to 6 months behind, with the period between order and shipment gradually lengthening.

The Union Truck Company, Bay City, Mich., has leased the old plant of the Pioneer Boat Company in that city and will manufacture its own commercial automobile bodies. The new light commercial body being manufactured by W. H. Kelly, Bay City, backed by a syndicate of business men,

has been well received by the trade and the company is manufacturing many bodies.

The Bardeen Paper Company, Owosso, Mich., has increased its capital stock from \$175,000 to \$1,000,000.

The Kuhlman Electric Company, which recently removed from Elkhart, Ind., to Bay City, Mich., has increased its business three-fold, and will construct an addition to its plant.

The National Machine Producer Company, Detroit, has been organized with a capital stock of \$150,000. William H. McGregor, Detroit, holds one-third of the stock.

Montgomery Ward & Co., Chicago, have purchased the plant of the Field-Brundage Company, Jackson, Mich., manufacturer of machinery. An addition to the plant will be erected and additional capital invested to enable the company to catch up on back orders. The present officials of the company will retire.

The National Body & Trimming Company, Detroit, has been incorporated by A. Cornelius Knapp, Thomas J. Gillan and Joseph M. Ackerson, of Detroit, with capital stock of \$100,000. The company will manufacture automobile bodies, tops and trimmings.

The Morrill C. Morley Mfg. Company, Benton Harbor, Mich., has increased its capital stock from \$35,000 to \$75,000.

The Continental Motors Company, Detroit, plans a reorganization, with a capital stock of \$18,500,000, of which \$15,000,000 will be common stock.

The Morton Salt Company and Harris Brothers, Chicago, have purchased the plant of the R. G. Peters Salt & Lumber Company, near Manistee, Mich.

A recent fire necessitated the rebuilding of part of the third floor of the fender department of the Briscoe Mfg. Company, manufacturer of automobile radiators, sheet-metal parts, and stampings, Detroit, Mich., and this will be completed within the next 10 days.

The Fuller & Sons Mfg. Company, Kalamazoo, Mich., maker of transmissions, will erect additions to its plant to double its output. The company expects to spend \$150,000 in new buildings and equipment in 1917.

Robinson & Campau, architects, Grand Rapids, Mich., took bids Dec. 18 on an addition to the plant of the Clipper Belt Lacer Company.

Cincinnati

CINCINNATI, OHIO, Dec. 18, 1916.

Many manufacturing plants in central Ohio were compelled to curtail operations last week due to the cutting off of the natural gas supply on account of the recent cold spell. No factories in Cincinnati proper have been inconvenienced. Domestic orders for machine tools continue to hold precedence over foreign business, although the latter has by no means been stopped. Corliss engine makers in southern Ohio are very busy and have considerable business in sight, but a few of them are devoting a part of their time in building machine tools and sugar-making equipment. The high cost of plates has compelled makers of boilers and heavy tanks to advance their selling prices. The advancing cost of castings will also compel makers of heavy machinery to mark up prices at an early date. The labor situation is improving, although more skilled mechanics could be employed by a number of plants. It is currently reported that several nearby manufacturers of munitions have laid off several hundred men, due partly to the slowness in securing material.

W. F. Robertson, president Robertson Steel & Iron Company, Cincinnati, Ohio, and also president Tower Mfg. Company, whose plant at Madison, Ind., was destroyed by fire Dec. 14, advises that a much larger building was obtained the day following the fire that will be fully equipped for making cold rivets, tacks and other specialties. The output of the old plant will be nearly doubled and every effort will be made to have the new plant in operation so as not to delay shipments to any appreciable extent. The company is in the market for rivet-heading machines, for making cold rivets, tack machines, transmission and power equipment. All communications should be addressed to the Cincinnati office.

The Columbia Machine Tool Company, Hamilton, Ohio, has been incorporated with \$50,000 capital stock by Frederick E. Goldsmith, E. S. Rich and others. It is not yet ready to give out its plans further than that it will fit up a building for the manufacture of machine tools.

The Dayton Insulating Die Company, Dayton, Ohio, recently formed, is equipping a plant for the manufacture of Bakelite dies.

The American Foundry & Castings Company, Dayton, Ohio, has recently received a large number of orders for automatic stokers from different parts of the country, but has made no plans for an immediate extension of its plant.

The Elwood Myers Company, Springfield, Ohio, has had plans prepared for a brick addition to its plant, 40 x 80 ft., two stories, principally for storage.

The Hamilton Smoke Consumer Company, Hamilton, Ohio, has been incorporated with \$10,000 capital stock by A. O. Rolfe, and others. It is understood that the company's smoke consumer will be manufactured under contract for the present.

The Trump Mfg. Company, Springfield, Ohio, has increased its capital stock from \$100,000 to \$125,000, and will increase its manufacturing facilities. The company makes water wheels and the principal new equipment to be installed just now is a traveling crane for its foundry and machine shop.

The Humpton-Scott Company, Columbus, Ohio, maker of stamped metal goods, has had plans prepared for a factory in Grove City, a suburb.

The Chamber of Commerce, Columbus, Ohio, is planning to erect a factory power building to house light manufacturing plants.

Harley Minchall, Xenia, Ohio, now operating an automobile repair shop, has purchased a new building and will fit it up for doing general machine-shop work.

John Hill, director of Public Service, Nelsonville, Ohio, will open bids Jan. 6 next for one compound duplex pumping engine, one steam-driven air compressor and one air receiver for the municipal waterworks.

The Marietta Mantel Company, Marietta, Ohio, has commenced work on its new factory, 50 x 150 ft., three stories, of regular factory construction. A four-story warehouse will also be erected.

The recent statement in THE IRON AGE that the Love Foundry & Machine Company, Winchester, Ky., had been merged with the Cincinnati Machine Tool Company, was incorrect. The Love Company was recently incorporated, and some of the stockholders and officers are in a similar capacity with the Cincinnati Pulley Machinery Company, at Covington, Ky. The officers of the Love Foundry & Machine Company are J. G. Hey, president; D. W. Hopkins, vice-president; L. B. Patterson, secretary and treasurer, and James Love, general manager.

Catalogs Wanted

The Dayton Time-Lock Company, Dayton, Ohio, is preparing plans for the erection of a complete plant in Dayton. The company will be pleased to receive catalogs covering machinery, small tools and kindred equipment suitable for the manufacture of adding machines, etc. George L. Baker is president.

Cleveland

CLEVELAND, OHIO, Dec. 18, 1916.

The market continues fairly active. The largest inquiry that has come out the past few days is for about \$50,000 worth of machine tools for a plant to be built in Cleveland to manufacture steel wheels for motor trucks. The company that will operate this plant will be organized about Jan. 1. A new building will be erected shortly. The National Carbon Company has purchased a number of machine tools, including two large planing machines. A good scattering demand is noted for single tools and lots of two or three machines. The call for turret lathes continues brisk, orders being for one or two machines.

C. H. Miller, formerly with the Champion Stove Company, Cleveland, has purchased a site on the Belt Line Railroad, on which, it is announced, he will build a new foundry to be used for general jobbing purposes and the manufacture of stove castings.

The Harris Automatic Press Company, Niles, Ohio, will move to Cleveland, having acquired a site on Seventy-first Street and the Belt Line Railroad. A plant will be erected for building printing machinery.

The Columbia Clutch Company, recently incorporated, will establish a plant in Cleveland to manufacture a new type of automobile clutches on a large scale. Operations will be started in January.

The Michigan Smelting Company, Detroit, Mich., has purchased the plant of the Komito Smelting Company, Cleveland. The latter has been incorporated with a capital stock of \$250,000 and will be known as the Valley Smelting Company.

The Doyle Machinery Company, Cleveland, has been incorporated with a capital stock of \$10,000 by J. A. Doyle and others.

It is announced that a plant representing an investment of \$2,000,000 will be erected in Charleston, W. Va., by the American Bottle Company, a subsidiary of the Owens Bottle Machine Company, Toledo, Ohio.

The Toledo Scale Company, Toledo, has purchased a site on which it plans to erect a new plant.

The Ladel Mfg. Company, New Philadelphia, Ohio, has acquired the plant of the Spicer Mfg. Company, and will erect additional buildings for machine and pattern shops.

The Transue & Williams Steel Forging Corporation, Alliance, Ohio, will make some additions to its forge shop, plans for which are being prepared by George S. Rider & Co., Cleveland.

The Allie J. Miller Company, Bellefontaine, Ohio, builder of automobiles, will enlarge its plant by the erection of a three-story building, 55 x 150 ft.

The Central South

LOUISVILLE, KY., Dec. 18, 1916.

Price advances are getting more and more attention in the steel and machinery trades in this section. Distributors of contractors' equipment note with a good deal of perturbation several recent advances on lines which they had felt could stand no more without immediately limiting sales. Shortages of materials is another item which is causing complaints. Eastern Kentucky coal operators had only a two-day car supply last week. Inquiries in all lines canvassed continue numerous, however, and manufacturers are busy. Steam pumps have been especially active, local manufacturers reporting some export orders.

The Kentucky & Indiana Terminal Company, Louisville, Ky., proposes to construct a large terminal warehouse at Louisville on Main Street between Fourteenth and Eighteenth, to cost about \$1,500,000, and to include the Southern, Monon and Baltimore & Ohio Railroad companies.

The Dixie Motor Car Company, Louisville, Ky., manufacturing an automobile in connection with the Kentucky Wagon Mfg. Company, has increased its capital from \$150,000 to \$400,000. L. V. Board is president.

The Boyd County Electric Company, Ashland, Ky., has increased its capital stock from \$32,000 to \$155,000.

The Wilson Stove Company, Metropolis, Ill., has let a contract to the Sherrill-Russell Lumber Company, Paducah, Ky., to construct a foundry 160 x 200 ft., a nickel shop, 70 x 94 ft., and a crate shop, 25 x 130 ft., at a cost of \$45,000.

C. E. Gibbons, Winchester, Ky., owner of the property, has let a contract to R. P. Scobee & Son, Winchester, for erection of a building to be occupied by the Love Foundry & Machine Company.

The Federal Dye Stuff & Chemical Company, Kingsport, Tenn., will make a 100-per cent increase in its capacity, raising the daily output to 100,000 lb. of dyes, chemicals, etc. George T. Bishop, 11 Pine Street, New York, is president.

The O. B. Andrews Company, Chattanooga, Tenn., is erecting 32,000 sq. ft. of additional factory space and will equip it at a cost of \$25,000 for the manufacture of folding boxes. S. H. Robertson is manager.

The Handy Tool Mfg. Company, Chattanooga, Tenn., has been incorporated with capital stock of \$10,000 by A. J. Corley, Sam P. Foster, A. J. Rogers and others.

The Southern Motor Company, Memphis, Tenn., has been incorporated with capital stock of \$50,000 by R. E. McKellar, S. H. Butler and J. M. Constable and others.

The Chickasaw Cooperage Company, Memphis, Tenn., whose plant was recently destroyed by fire at a loss of \$300,000, has let contract to L. T. Lindsey, Memphis, for rebuilding the factory.

The Memphis & Rugby Railroad, Memphis, Tenn., proposes to establish a power plant at Rugby Park.

Indianapolis

INDIANAPOLIS, IND., Dec. 18, 1916.

The Highway Tractor Company, Indianapolis, has been incorporated with \$2,000,000 capital stock to manufacture tractors. It has purchased 25 acres for a plant to cost about \$200,000. Ground has been broken near the Indianapolis Speedway for the main building, 200 x 400 ft., of steel and concrete. The company expects to manufacture 5000 10-ton tractors the first year. Among the stockholders are Carl G. Fisher and James A. Allison of the Prest-O-Lite Company; Henry F. Campbell of the Stutz Motor Company, Indianapolis; B. R. Parrott, Jackson, Mich.; A. E. Schaaf, Poughkeepsie, N. Y.; Louis Goodhart, St. Louis, and M. N. Stewart and Forrest C. Bagley, Jackson, Mich.

The Oakes Company, Indianapolis, manufacturer of automobile parts, has increased its capital stock from \$250,000 to \$450,000.

The Ferguson Mfg. Company, Indianapolis, has been incorporated with \$50,000 capital stock to manufacture beet harvesters. The directors are W. M. Ferguson, L. and W. Rentz.

The E. B. Lanman Company, East Chicago, Ind., has been incorporated with \$20,000 capital stock to manufacture nuts, vehicle parts and specialties. The directors are C. Seddon, H. A. and E. B. Lanman.

The Noblesville Heat, Light & Power Company, Noblesville, Ind., has increased its capital stock from \$100,000 to \$250,000.

The Marion Association of Commerce, Marion, Ind., has closed a contract with Morton Murphy and William Allmure, Janesville, Wis., for the construction of a factory to manufacture electric cookers.

The C. R. Folsom Iron Works, Inc., Walkerton, Ind., has been incorporated with \$35,000 capital stock to manufacture iron tanks and other metal products. The directors are Oscar C. Shockney, William A. Endley and V. W. Hardenbrook.

The Just Right Candlestick Company, Indianapolis, has been incorporated with \$10,000 capital stock to manufacture novelties. The directors are Johan Hansen, H. C. Schmidt and J. E. McNamara.

The Brazil Ice Company, Brazil, Ind., will build a new plant which will treble its capacity.

The Cellulite Furniture Company, Evansville, Ind., has been incorporated with \$5,000 capital stock to manufacture furniture. The directors are M. D. Helfrich, O. R. Braun and H. F. Weaver.

The American Safe Company, Anderson, Ind., has been incorporated with \$25,000 capital stock to manufacture safes and vaults. The directors are M. G. Reynolds, J. C. Groble and Henry Schmidt.

The American Radiator Company, Bremen, Ind., is erecting an addition to its plant which will double its capacity.

The Allmure Mfg. Company, manufacturer of electric stoves, will move its plant from Janesville, Wis., to Marion, Ind.

The National Automatic Tool Company, Richmond, Ind., will build a second addition to its plant, giving 3000 sq. ft. of floor space, which will be used for storage and painting of small castings.

The foundry now under construction for the Standard Wheel Company, Terre Haute, Ind., will be for the manufacture of malleable iron castings for wheels and automobile hubs. It will be completed about Feb. 1.

St. Louis

ST. LOUIS, MO., Dec. 18, 1916.

Machine tool buying has continued actively the past week. Requirements are now for domestic needs and not much affected by the peace talk. The aggregate of business is keeping all sources of supply under pressure from practically all directions. No lists are appearing at all, aside from some grouped railroad inquiry for repair shop needs, but for the most part this call is subdivided into negotiable quantities and general lists not put on the market. The roads of the Southwest are probably buying a considerable equipment, but the purchases are being made in such manner as to render it difficult to determine the aggregate.

The Beaker Mfg. Company, St. Louis, has been incorporated with a capital stock of \$12,000 by Otto E. Kaiser, Evelyn C. Koenig and Guy Golterman to manufacture metal and other products.

The Modern Brass Foundry Company, St. Louis, has been incorporated with a capital stock of \$15,000 by Carl G. Strotz, John P. Hill and Louis C. Strotz and will equip a brass and bronze foundry.

The Key Boiler Equipment Company, St. Louis, has been incorporated with a capital stock of \$30,000 by N. P. Finigan, G. E. Southwick and M. M. Myers to manufacture boiler plugs, etc.

The Wagner Electric Mfg. Company, St. Louis, has plans for increasing its capital stock from \$2,000,000 to \$5,000,000 and to add still further to its manufacturing plants.

The Magnet Mfg. Company, St. Louis, recently incorporated by I. Korsch, M. D. Frumberg and A. L. Jacobs, will equip a plant for the manufacture of electric switch boxes.

The Thwing-Evans Company, Kansas City, Mo., has been organized by Fred H. Thwing, Harry W. Evans, and others, and will erect a plant for the refining of oil, etc., at a cost of \$1,000,000.

The Brass & Metal Mfg. Company, Kansas City, Mo., A. U. Dann, president, will equip an addition to its cartridge manufacturing plant covering about 25,000 sq. ft. of floor space.

The Arkansas Lime Company, Ruddell, Ark., will install equipment for the manufacture of a patented wrench.

The Oklahoma Structural Steel Company, Tulsa, Okla., has been incorporated with a capital stock of \$10,000 by

J. W. Sloan, P. M. Iverson and E. A. Shaw, and will equip a steel fabricating plant.

The Drane-Owen Tank Company, Tulsa, Okla., has been incorporated with a capital stock of \$25,000 by F. M. Drane, C. A. Mechling, and others, to manufacture tanks.

The White Star Refining Company, Oklahoma City, Okla., has been incorporated with a capital stock of \$250,000 by LeRoy Paddock, John B. Enfield and George M. Campbell.

The Oneta Refining Company, Oneta, Okla., has been incorporated with a capital stock of \$50,000 by F. D. Misener, Charles F. Bisett, and others, and will equip a plant there, as well as one at Tulsa, under the corporated title of the Misener Gasoline Company.

The Oklahoma Tool & Supply Company, Tulsa, Okla., has been incorporated with a capital stock of \$10,000 by J. W. Sloan, P. M. Iverson, and others.

The Weleetka Waterworks Company, Weleetka, Okla., C. A. Parish, general manager, will install a filtration plant of 500,000 gal. per day capacity, with motor-driven pumps.

The C. F. Massey Company, 122 South Michigan Avenue, Chicago, tank manufacturer, will equip a plant at Meridian, Miss., for the manufacture of reinforced concrete railroad trestles, bridge decks, culvert, sewer pipe, etc.

The Caddo Oil & Refining Company, capitalized at \$10,000,000, will equip several plants in the Caddo field. R. E. Robinson & Co., 30 Broad Street, New York, and E. W. Clark & Co., 321 Chestnut Street, Philadelphia, bankers, are active in the development of the business.

Texas

AUSTIN, TEX., Dec. 16, 1916.

The plant of the Amarillo Sash & Door Company, Amarillo, recently destroyed by fire, will be rebuilt at a cost of about \$50,000.

Schneider Brothers, Vidor, will build a brick manufacturing plant, consisting of four kilns and 18 drying sheds, with a daily capacity of 50,000 brick.

San Benito has voted \$600,000 in bonds to purchase the pumping plants and canals of the San Benito Land & Water Company and to enlarge and extend the system.

The plant of the E. B. Hays Machinery Company, Marshall, which was recently destroyed by fire, will be rebuilt at a cost of about \$30,000.

The Texas Company of Houston is reported to be considering plans for the construction of an electric power plant at or near Tampico, Mexico, to furnish power for operating the oil pipe line pumping plants and other machinery connected with its oil industry and that of other large companies in the Tampico oil fields.

It is announced that the Pierce-Fordyce Oil Association will enlarge its refinery at Texas City at a cost of about \$300,000, and build a case and can factory at Galveston to cost \$100,000. It will also enlarge its refinery at Fort Worth from 8000 to 20,000 bbl. per day and will lay an 8-in. pipe line from the Headton, Okla., fields to the Fort Worth plant at a cost of about \$1,700,000, including pumping stations.

California

LOS ANGELES, CAL., Dec. 13, 1916.

The Los Angeles Shipbuilding Company, Los Angeles, has filed application with the Harbor Commission for lease of a site on the west side of Los Angeles Harbor, San Pedro, upon which it proposes to erect a shipbuilding plant to cost \$500,000. E. G. Eckstrom, 237 I. W. Hellman Building, Los Angeles, is president.

Joseph Patrick, 1041 South Broadway, Los Angeles, will build a new brick machine shop, 17 x 50 ft., at 1035 South Broadway.

The Aston Motor Car Company, Los Angeles, has leased the building to be erected by W. G. Hutchinson on Figueroa Street, near Eleventh Street, about 50 x 150 ft., as a garage.

The Baker Iron Works, North Broadway, Los Angeles, will build a steel frame machine shop, 80 x 180 ft., at a cost of \$7,250.

The Axelson Machine Works, 1406 San Fernando Street, Los Angeles, specializing in oil well machinery, has had plans prepared for a plant to comprise seven buildings to be erected at Huntington Park, as follows: Machine shop, 75 x 126 ft.; foundry, 100 x 156 ft.; forge shop, 25 x 75 ft.; pattern shop, 25 x 80 ft.; pattern storage, 25 x 80 ft.; garage, 25 x 100 ft.; and office, 30 x 100 ft.

The city of Los Angeles will build a one-story machine shop, 40 x 156 ft., at 217 San Fernando Boulevard.

The Warman Steel Castings Company, 650 South Los Angeles Street, Los Angeles, has had plans prepared for a plant at Huntington Park, to consist of foundry, 113 x 240 ft., with a 10-ton traveling crane; pattern shop, 40 x 60 ft.; pattern storage, 40 x 40 ft.; and office, 24 x 30 ft. The company plans to remove its present plant at Redondo to the new site.

The Greer-Robbins Garage, Flower Street, near Twelfth Street, Los Angeles, plans a two-story addition, 70 x 155 ft.

The Union Oil Company, Los Angeles, has acquired 200 acres at Los Angeles Harbor, Wilmington section, and is reported to be planning for the erection of an oil-refining plant to cost \$2,000,000. A franchise for a pipe line has been granted, and the company is now arranging with the city for the construction of a wharf.

The Arrowhead Springs Company, 801 South Spring Street, Los Angeles, has had plans prepared for a bottling plant, 150 x 250 ft., at Washington Street and Compton Avenue, of reinforced-concrete, estimated to cost with machinery \$150,000. F. W. Handschy is general manager.

The Western Metals Company, Security Building, Los Angeles, will build a new one-story plant, 17 x 96 ft., on Belle Port Avenue, at Harbor City.

The Southern Counties Gas Company, Santa Ana, Cal., will build a one-story machine shop at 501 North Sycamore Street at a cost of \$2,200.

The Santa Fé Railroad, San Bernardino, will build the following additions to its local shops to replace structures recently destroyed by fire: Coach and car-building shop, 150 x 245 ft.; mill building, 80 x 230 ft.; cabinet and upholstery shop, 73 x 132 ft.; and refrigerator car repair shop.

The Valley Ice Company, Fresno, Cal., has acquired a site near Modesto for the erection of a new ice manufacturing plant, of concrete, 115 x 600 ft., with a capacity of 200 tons per day. James R. Erskine is general manager.

The American Beet Sugar Company, Chino, has had plans prepared for a machine shop, 60 x 154 ft. L. M. Edmunds is local manager.

The Magnesite Refractories Company, Porterville, has been incorporated with a capital of \$200,000 to build a reduction plant for the manufacture of magnesite products. Charles B. Stetson, San Francisco; J. L. Mitchell, Porterville; F. J. Shuh, Porterville, and E. J. Heinor, San Francisco, are the incorporators.

The Santa Fé Railroad, Los Angeles, Cal., has acquired property near the city limits of Old Town, San Diego, and is reported to be planning for the erection of a machine shop, blacksmith shop, roundhouse and repair plant. The company has had plans prepared for an ice plant at Winslow, Ariz., 80 x 128 ft. G. W. Harris, Kerckhoff Building, Los Angeles, is chief engineer.

The Pacific Northwest

PORLAND, ORE., Dec. 12, 1916.

The machinery business is holding up remarkably well for this time of year, and shows little curtailment. Shipbuilding plants on Puget Sound and the Columbia River have placed a number of important orders, and continue in the market for tools of large capacity, although large lists are the exception. Considerable single-tool business from lumber and mining companies is also noted and the aggregate of orders from implement shops and small manufacturing plants is large. Inquiries for mill and wood-working machinery are numerous, but business is being closed slowly, except for routine needs. Improvements are under way at several of the paper mills, with some new development in prospect. Hydroelectric machinery and equipment for reclamation work and general heavy construction is in good demand.

The continued shortage of cars is likely to be slightly improved by the annual shut-down of the mills and logging camps in the Northwest for the holidays, lasting at least 10 days. At present lumbermen are averaging about 50 per cent of their immediate requirements in cars. Orders are good, but mills are only accepting those on which they can make deliveries. Production has been curtailed almost 25 per cent. These conditions have had the effect of stiffening the market, and further advances are anticipated.

The recent demand from railroad companies who are building new equipment and adding to their rolling stock, has created a brisk business for car manufacturers, particularly in Portland and Seattle. Several large contracts are pending.

The British Government recently placed an order for 12,000,000 ft. of spruce lumber for knock-down houses and aeroplane stock with R. A. Wernich and Louis Nicolai, of Portland, to be delivered within one year.

The Pacific Coast Welding Company, Seattle, has been

incorporated with a capital of \$5,000 by J. P. and B. D. Engstrom.

The Bellingham & Northern Railroad, Bellingham, Wash., is preparing to add new equipment, including four 70-ton locomotives and a lot of logging cars.

A number of mine owners have purchased the Nevada Engineering & Supply Company, Reno, Nev., the officers of which are George Wingfield, president; J. L. Kirchen, vice-president; L. F. Curtis, secretary-treasurer. The company has a foundry and machine shop, which will be greatly enlarged to handle work on mining machinery. It will also add a stock of general equipment and supplies.

The Northern Pacific Railway Company has awarded a contract for the construction of new terminals on Hanford and Occidental streets, Seattle. The work will cost \$150,000, and includes roundhouse, machine and blacksmith shop, etc.

It is announced that the Southern Pacific Railway Company plans improvements in Marshfield, Ore., amounting to more than \$250,000.

The People's Shipbuilding Company, Tacoma, Wash., has recently been incorporated for \$250,000, and plans the immediate construction of shipyards for building wooden vessels, according to E. Knapp Darien, one of the trustees. The original plant will cost \$50,000 and work will begin immediately.

The Chicago, Milwaukee & St. Paul Railway will build additional docks and warehouses, as large as those now under construction at its terminals in Tacoma. Plans are now being drawn.

Plans have been completed by the Vancouver Dry Docks, Ltd., Vancouver, B. C., for construction of a floating drydock to handle a boat of 18,000 tons. A shipbuilding and repair plant will be constructed as soon as the dock is completed. Charles Meek is president.

The Cameron-Genoa Shipbuilding, Ltd., Victoria, B. C., plans the construction of 25 auxiliary schooners. J. H. Price is president.

The plant of the Electric Heating & Mfg. Company, Seattle, Wash., manufacturer of water heaters, radiators, etc., was destroyed by fire recently. It will be rebuilt.

A. J. Capron, Ainsworth Building, Portland, representative of the Goheen Mfg. Company, Canton, Ohio, states that his company recently purchased a site on the South Waterway, on which it will erect a paint plant to cost \$250,000, and to include four main buildings of concrete. Work will start about Jan. 1.

The Specialty Box Mfg. Company, St. Johns, Ore., manufacturer of folding crates, step ladders, lawn swings, etc., has been purchased by W. G. Pennock and William Christman, who will enlarge the plant and install more machinery.

Plans are nearing completion for the proposed paper manufacturing plant to be built at Port Angeles, Wash., by Whalen Brothers, who operate a paper plant at Mills Creek, B. C. The original plans called for a daily capacity of 60 tons, but it will be built on a much larger scale. The company will be incorporated shortly for \$1,000,000, and is said to be backed by Peabody Houghteling & Co., Chicago.

The Willamette Iron & Steel Works, Portland, has recently signed contracts for the construction of 12 boilers, costing about \$250,000, for installation in 6 steel steamers under construction by the Albina Engine & Machine Works, for Norwegian interests. The Willamette Works has now under contract construction of 51 boilers for steel steamers now being built on the Pacific coast, the work totaling between \$1,500,000 and \$2,000,000.

Canada

TORONTO, Dec. 18, 1916.

Mark Workman, president Dominion Steel Corporation, Montreal, states that his recent visit to the United States was for the purpose of looking over a few industrial plants and also for the securing of additional equipment for his corporation to increase the output of finished products. The new equipment will include a substantial number of Koppers by-product coke ovens.

The Hayes Wheel Works, Chatham, Ont., will be converted into a munitions plant. The British Government has awarded a contract to the company for the manufacture of 50,000 shells to be completed before June 1. Additions will also be made to adapt the plant to this work.

The plant of the Quaker Oats Company at Peterboro, Ont., was destroyed by fire Dec. 11 with a loss to buildings and machinery of nearly \$2,000,000. This was one of the largest plants of its kind in Canada and it is stated it will take at least two years to rebuild. The whole plant with the exception of the concrete elevator will be a total loss. O. C.

Kirn, chief engineer of the company, is at present in Peterboro.

The Sherbrooke Construction Company has received the contract for the erection of a blacksmith shop for the Ingersoll-Rand Company at Sherbrooke, Que., to be of brick construction and cost \$20,000.

The Dominion Copper Products Company has increased its capital stock from \$1,000,000 to \$3,500,000. The company is one of the subsidiaries of the Dominion Bridge Company of Montreal, which started with a capital of \$400,000 and increased it to \$1,000,000 last August. Another subsidiary of the Bridge Company is Montreal Ammunitions, Ltd., with a capital of \$300,000. It has been intimated that a consolidation of the two companies is under consideration.

The Corbett Foundry & Machine Company, Owen Sound, Ont., is in the market for an iron planer, 30 x 30 in. with 6 or 8 ft. bed.

J. J. Carrick, Port Arthur, Ont., was the successful tenderer for the Pic River pulp and timber limits, comprising 1400 square miles of timber, south of the Nipigon game reserve. As a consideration of the lease he is required to erect a pulp mill costing \$1,000,000, to have a daily output of 150 tons.

The Canadian Desmon-Stephen Mfg. Company, Market Street, Hamilton, recently incorporated to manufacture steam ejectors, abrasive wheels, etc., is preparing to erect a plant there. The head office of the company is at Urbana, Ohio.

An addition will be made to the plant of the Ford Motor Company of Canada at London, Ont., to cost \$25,000. Plans are being prepared at the head office of the company at Ford City, Ont.

The Acme Tire & Rubber Company, 471 Yonge Street, Toronto, proposes to erect a plant at Oakville, Ont., and is carrying on negotiations for a site and concessions.

The Keenan Woodenware Mfg. Company, Owen Sound, Ont., proposes to build an addition to its plant at a cost of \$20,000.

The Pembroke Machinery Company, Pembroke, Ont., is preparing plans for a machine shop to cost \$12,000. New lathes and other machinery will be required.

The Sarnia Metal Products Company, Sarnia, Ont., plans an addition to its plant.

The H. Mueller Mfg. Company, Sarnia, Ont., will erect and equip buildings to manufacture brass. The number of its employees will be increased from 600 to nearly 1000.

The C. & J. Hadley Company, Chatham, Ont., has commenced the erection of a sawmill to cost \$10,000; equipment and electrical supplies will be purchased.

The Dominion Wire Cloth Mfg. Company, Ltd., Armstrong Street, Ottawa, will build an addition to cost \$4,000.

The Canadian National Carbon Company, 99 Paton Road, Toronto, has commenced the erection of a factory to cost \$12,000.

The Dominion Machinery Company, 110 Church Street, Toronto, will erect a plant at a cost of \$5,500.

The Nashwaak Pulp & Paper Company, St. John, N. B., will make extensions and install additional machinery in the plant of the Edward Partington Pulp & Paper Company, recently purchased. The improvements will cost \$250,000.

The Pembroke Electric Light Company, Pembroke, Ont., is having plans prepared for a power house at Black River, Ont., to cost \$7,000. It will be in the market for one generator, water wheels, etc.

L. S. O'Connor, superintendent of the waterworks, Thorold, Ont., is in the market for a new turbine pump and electric motor.

The plant of the Dickson Bridge Works Company, Ltd., Campbellford, Ont., was destroyed by fire with a loss of \$60,000.

Cornwall, Ont., will erect a pumping station to cost \$25,000.

J. H. Connor, Pretoria Avenue, Ottawa, is making arrangements for the erection of a plant for the manufacture of washing machines, etc.

The Cobourg Steel Company, Cobourg, Ont., will make additions to its plant.

The International Mfg. Company, Ltd., Montreal, has been incorporated with a capital stock of \$1,000,000 by John A. Harriss, Rufus L. Patterson, Alfred O. Hoyt and others of New York City to manufacture ordnance, firearms, fuses, etc. The company recently commenced the erection of a plant at Montreal to cost \$1,000,000.

The Lytle Engineering Company, Ltd., Montreal, has been incorporated with a capital stock of \$50,000 by Francis G. Bush, George R. Drennan, Herbert H. Jackson and others to manufacture boilers, engines, etc.

The Atlas Metal & Alloys Company of Canada, Ltd., Mon-

treal, has been incorporated with a capital stock of \$50,000 by Charles M. Holt, Alexandre Chase-Casgrain, Errol M. McDougall and others.

A. H. Chave & Co., Ltd., Montreal, have been incorporated with a capital stock of \$50,000 by Archibald H. Chave, Woodlands, Que., Clifford L. Morham, Phillip Brais and others of Montreal, to manufacture lumber.

The Michipicoten Power & Paper Company, Ltd., Toronto, has been incorporated with a capital stock of \$6,500,000 by William A. J. Case, 801 Dominion Bank Building; James B. Taylor, William M. Smith and others.

E. C. Gatien, secretary of the City Council, Sherbrooke, Que., is in the market for a 4-ton traveling crane.

The Steel Company of Canada, Hamilton, Ont., proposes to make additions to its plant.

The Beacon Match Company, Bracebridge, Ont., proposes to build a factory there at a cost of \$45,000.

Fire destroyed the boiler department and coal elevators at the plant of the Aetna Power Company, Drummondville, Que., on Dec. 5. The damage will be repaired without delay.

The North Bay Toy Company, North Bay, Ont., will erect shortly a factory to cost \$25,000.

The William Galloway Company, Waterloo, Iowa, will erect an agricultural implement plant at St. Boniface, Man. J. B. Payne, Winnipeg, Man., is active in the enterprise.

Government Purchases

WASHINGTON, D. C., Dec. 18, 1916.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until, date not set, schedule 508, for one 16-in. automatic tapping machine for Boston; schedule 529, for one 24-in. bench drilling machine, one double emery grinding machine and one screw-cutting engine lathe, all for Mare Island.

Bids were received at the Bureau of Supplies and Accounts, Navy Department, Washington, Dec. 12, for supplies for the Naval Service as follows:

Schedule 390, Ordnance

Class 121, Newport—Two universal grinding machines—
Bid 12, \$951.50; 79, \$1,949 and \$1,499; 109, \$890.

Class 122, Newport—One grinding outfit—Bid 12, \$1,569 and \$1,269.

Schedule 391, Ordnance

Class 123, Washington—One selective head lathe—Bid 7, \$1,898.50; 52, \$2,261; 74, \$2,320; 96, \$2,415; 104, \$2,195.

Class 124, Washington—One motor-driven milling machine—
Bid 12, \$3,660; 74, \$4,856; 136, informal.

Class 125, Washington—One boring, drilling and milling machine, complete—
Bid 81, \$6,940; 104, \$5,800.

Class 126, Washington—One universal plate cutter—
Bid 104, \$2,725.

Class 127, Washington—Two engine lathes—
Bid 74, \$1,875; 96, \$3,095; 114, \$2,201.

Class 128, Washington—One toolmaker's engine lathe—
Bid 114, \$1,055.

Class 129, Washington—Two sensitive drilling machines—
Bid 52, \$68; 96, \$200; 114, \$107.25; 144, \$87 and \$192.

Class 130, Washington—One universal grinding machine—
Bid 12, \$960; 82, \$995; 109, \$925; 136, informal.

Class 131, Washington—One universal milling machine—
Bid 12, \$1,840; 49, \$1,759 and \$2,113; 52, \$1,823; 74, \$2,180; 136, informal; 165, \$1,316.

Class 132, Washington—One heavy milling machine—
Bid 12, \$2,558; 74, \$2,730; 165, \$2,484.

Class 133, Washington—Two universal grinding machines—
Bid 74, \$2,460; 82, \$2,322.50.

Class 134, Washington—One universal tool and cutter grinder—
Bid 12, \$798; 49, \$610.50; 74, \$590; 104, \$754; 109, \$515; 144, \$497; 165, \$615.

Class 135, Washington—Three bench milling machines—
Bid 52, 118; 109, \$154 and \$176; 136, informal.

Class 136, Washington—One flat turret lathe—
Bid 74, \$2,760.

Schedule 393, Steam Engineering

Class 151, Boston—One disk grinder and roll sander—
Bid 29, \$1,025; 58, \$1,026; 112, \$765 and \$785; 118, \$1,070 and \$1,150.

The names of the bidders and the numbers under which they are designated in the above list are as follows:

Bid 7, Aumen Machinery Company; 12, Brown & Sharpe Mfg. Company; 29, Chandler & Farquhar Company; 49, Federal Sales & Service Company; 52, The Fairbanks Company; 58, Gardner Machine Company; 74, Kemp Machinery Company; 79, Knickerbocker Supply Company; 81, Lucas Machine Tool Company; 82, Landis Tool Company; 96, Manning,

Maxwell & Moore, Inc.; 104, Niles-Bement-Pond Company; 109, D. Nast Machinery Company; 112, Oliver Machinery Company; 114, Pratt & Whitney Company; 118, Henry Prentiss & Co.; 136, Swind Machinery Company; 144, Universal Trading Company; 165, Oesterlein Machine Company.

NEW TRADE PUBLICATIONS

Grinding Machines.—S. B. Patch & Sons Company, Streator, Ill. Circular. Mentions two types of grinding machines for use with wheels 18 in. in diameter and having a 3-in. face. Engravings of the machine with and without wheel guards are presented, and a brief description of the machine, supplemented by a condensed table of specifications, is included.

Storage Battery Industrial Trucks.—Jeffrey Mfg. Company, Columbus, Ohio. Bulletin No. 200 Describes a line of storage battery trucks which are adapted for use in industrial plants, factories, warehouses, foundries, lumber yards, copper smelting plants, etc. Emphasis is laid upon the savings in time, labor and expense effected by the trucks, which are adapted to transfer all classes of material and are designed to carry the load as well as push or pull loaded cars, no skilled labor being required for operation or handling. Another feature that is prominently brought out is the flexibility of the track system used, which gives a wide range of operation and permits the truck to run over tracks and in and out of buildings or anywhere about the plant with safety, as no overhead wires are required. Illustrations in the bulletin show different types of trucks working under widely varying conditions, the captions of the cuts bringing out the size of the truck, where it is used and the work it is doing. In this connection condensed specification tables of the trucks are presented in almost every case.

Twist Drills and Reamers.—Whitman & Barnes Mfg. Company, Akron, Ohio. Calendar hanger measuring 13½ x 19 in. Engravings of a standard twist drill and reamer of the company are presented in the upper portion of the hanger with a view of the plant at Akron where these tools are manufactured, and another one of the Chicago plant, which is devoted to the manufacture of screw and drop forged wrenches, drop forgings, spring cutters, etc. The leaves, which occupy about half of the hanger, have the dates for the current month in large block figures set off by rules, the number of days that have elapsed being indicated by small figures in each box. Calendars for the preceding and succeeding months are given on each leaf, together with a brief reference to some one of the company's lines. The back of the leaf contains a number of illustrations of different tools and a calendar for the years 1916, 1917 and 1918 is given on the last sheet.

Machine Tools.—Hilles & Jones Company, Wilmington, Del. Catalog No. 8. Size, 9 x 12 in.; pages, 221. Presents illustrations and brief descriptions of a line of machine tools for working plates, bars and structural shapes. These include vertical punching and shearing, coping, planing and bending and straightening machines, spacing tables, plate bending rolls and flanging clamps. A brief general description of the construction of each class is given at the beginning of the section devoted to it and each division contains illustrations, brief descriptions and specification tables of the various sizes and styles of machine going to make up that particular group. A comprehensive index is included.

Fuel Oil Engines.—Chicago Pneumatic Tool Company, Fisher Building, Chicago, Ill. Bulletin No. 34-W. Covers a line of oil engines employing low-grade fuel. The description of the engine is quite complete and the text is supplemented by a number of halftone engravings of the various parts, as well as views of the engines themselves. Condensed specification tables of the single and duplex types of engines are included, together with a number of engravings showing the engine in use.

Hoisting Machinery.—Brown Hoisting Machinery Company, Cleveland, Ohio. 1917 calendar, 12½ x 18½ in., white on black. 13 illustrations, the largest 6% x 10% in. Gives views of the Brown plant and of machinery which it has built for service in ore and coal handling. One reproduction shows 28 Brownhoists at Vladivostok, Russia; another, three traveling bridges commanding the ore yard of the Federal Furnace Company, South Chicago, Ill. A view of the dock and yards of the Pittsburgh Coal Company, Duluth, Minn., includes several traveling bridges, vessels and huge coal piles. Two car dumpers of the Hocking Valley Railroad Company, Toledo, Ohio, were photographed for another view.

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